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# **SOURCES**RESOURCES ABSTRACTS



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# SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Resources Research, U.S. Department of the Interior



VOLUME 5, NUMBER 5 MARCH 1, 1972

W72-02253 -- W72-02952

WATER RESOURCES ABSTRACT

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

## FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the Water Resources Thesaurus. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCU-MENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established disciplineoriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center Office of Water Resources Research U.S. Department of the Interior Washington, D. C. 20240

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**ABSTRACT SOURCES** 

## SELECTED WATER RESOURCES ABSTRACTS

## 01. NATURE OF WATER

## 1A. Properties

ANOMALOUS WATER POLYMERIC MATERIALS. OTHER AND

Available from the National Technical Information Available from the National 1 echnical information Service, Springfield, Va., 22151 as AD-726 761, \$3.00 in paper copy, \$0.95 in microfiche. Battelle-Columbus Laboratories Semiannual Technical Re-port, 1971. 75 p., 25 fig. 7 tab, 5 ref, 3 append. Army Missile Command DAAH01-71-C-0491.

Descriptors: \*Gels, \*Water chemistry, \*Chemical properties, \*Water types, Analytical techniques, Water properties, Laboratory tests, Water structure, Spectrophotometry, Infrared radiation. Identifiers: \*Anomalous water, \*Polywater, Capillaries

During the preparation of anomalous material from water, a residue was found in the capillary tubes even though the tubes themselves had been cleaned even though the tubes themselves had been cleaned prior to the preparation. All of the elements found in either the water washings of capillary tubes or in preparations from uncleaned tubes were detected in the preparations from cleaned tubes. All tube washings and preparations gave similar infrared spectra. However, there were distinct and consistent differences in the exact frequencies of these absorption bands between the spectra of liquid water tube washings and the spectra of anomalous material preparation, whether from cleaned or un-cleaned tubes. These spectral differences cannot be explained by changes in the amounts of the ele-ments thus far detected. The frequency differences definitely show changes in chemical composition between preparations and washings and strongly in-dicate that the preparation of anomalous materials from water cannot be accounted for solely on the basis of extraction by liquid water of elements from the glass of which the capillary tubes are made. Un-like the tube washings and preparation with water, gave spectral differences which were reflected by changes in elemental composition. (Woodard-USGS) W72-02264

ANOMALOUS WATER. NUCLEATION. GROWTH AND PROPERTIES,

Cold Regions Research and Engineering Lab., Hanover, N.H. 06Anomalous Water, Nucleation, Growth and Properties, G. K. Swinzow.

Cold Regions Research and Engineering Laboratory Special Report 156, May 1971. 36 p. 23 fig, 2 tab, 24 ref.

Descriptors: \*Water chemistry, \*Chemical properties, \*Water types, \*Water properties, \*Gels, Laboratory tests, Test procedures, Condensation, Silica, Water structure, Quartz, Vapor pressure, Refractivity.
Identifiers: \*Anomalous water, \*Polywater, Capil-

An anomalous liquid phase forming in an atmosphere of reduced water vapor pressure was investigated. The liquid was grown in capillary tubes. Technical experimental refinements resulted in high nucleation rates not previously observed. An examination of vapor pressures disclosed the relationship of procleating growth and equilibric of tionship of nucleation growth and equilibria of anomalous water. The possibility of nucleation and growth of anomalous water on flat surfaces was growth of anomalous water on flat surfaces was confirmed by observation. Anomalous water was nucleated and grown on glass, quartz, Teflon, polyethylene and metal. Growth rates on free flat surfaces were higher, than those obtained from capillary tubes. Refractive indexes and other pro-perties were measured directly. The new method of growing anomalous water outside capillary tubes is an advantage that may lead to large-scale produc-tion. Neither investigation of nor conclusion on the

nature of the substance was made. Its low freezing nature of the substance was made. Its low freezing temperature, high boiling temperature, low vapor pressure and high viscosity, reported by previous investigators and observed by the author, are of primary importance and justify a search for large-scale preparation methods. (Woodard-USGS) W72-02304

## 1B. Aqueous Solutions and Suspensions

ANOMALOUS WATER AND OTHER POLYMERIC MATERIALS. Battelle Columbus Labs., Ohio. For primary bibliographic entry see Field 01A. W72-02264

## 02. WATER CYCLE

#### 2A. General

AN ANALYSIS OF HYDROLOGIC TIME SE-RIES AND GENERATION MODELS OF SYNTHETIC FLOWS FOR SOME INDIANA WATERSHEDS.

Purdue Univ., Lafayette, Ind. Water Resources

I. T. Kisisel, and J. W. Delleur.

Available from the National Technical Information Service as PB-205 153, \$3.00 in paper copy, \$0.95 in microfiche. Indiana Water Resources Research Center, Lafayette, Technical Report No 19, July 1971. 33 p, 27 fig, 3 tab, 30 ref. OWRR-A-020-

Descriptors: \*Stochastic processes, \*Markov processes, Statistical models, Synthetic hydrology, Probability, \*Rainfall-runoff relationships, sequence, \*Time series analysis, \*Watersheds (Basins), \*Indiana, Evapotranspiration, Discharge (Water), \*Model studies. Identifiers: Fiering, Spectral analysis.

This is a first part of a program of analysis of hydrologic time series and stochastic models for the synthetic generation of rainfall and runoff sequences principally in Indiana. The study was conducted on 12 watersheds varying in area from 100 to 3750 square miles. All the watersheds had 20 years of more of continuous records of rainfall, temperature and runoff. It was found that the probability distributions of the annual discharge, of the standardized logarithms of the monthly flows, and the normalized square root of the monthly precipitation were approximately normal. A spec-tral analysis of the monthly raw data and trans-formed data revealed a strong annual component. This cyclic component was removed by normaliza-tion. The logarithmic and the square root transformations of the monthly runoffs and precipitations were performed for further analysis. First order autoregressive process can be used to generate annual flows. A first order Markov process of the Fiering type simulates the sequence of normalized logarithms of monthly flows. Finally the hydrologic process of monthly rainfall-evaporation-runoff was simulated by a linear dynamic stochastic model with multiple inputs.
W72-02351

## HYDROMETEOROLOGICAL NETWORKS IN WYOMING - THEIR DESIGN AND USE.

Proceedings of Hydrology Seminar, University of Wyoming, May 20-21, 1971; Laramie, Wyoming University Water Resources Research Institute Re-port, 1971. 167 p.

Descriptors: \*Water resources development, \*Conferences, \*Publications, \*Wyoming, \*Hydrology, Programs, Hydrologic data, Data collegions, \*Designer, \*Conference, \*Wyoming, \*Wyo lections, Project planning, Watershed manage-ment, Network design, Surface waters, Groundwater, Climatology, Hydrologic cycle, Streamflow, Stream gages, Water supply, Water demand, Water

A seminar for hydrologists interested in hydrology of Wyoming was held at Wyoming University, May 20-21, 1971. Information was presented concerning the present networks of streamflow, climatological, and snowcourse data collections. These presentations were by agencies establishing and operating the networks. A second portion of the program consisted of 12 papers by individuals who utilize the hydrometeorological data. (Woodard-USGS) W72-02748

TRANSFORMATION OF THE HYDROLOGIC REGIME AND WATER BALANCE OF AN AREA (PREOBRAZOVANIYE GIDROLOGICHESKOGO REZHIMA I VOD-NOGO BALANSA TERRITORII), Akademiya Nauk SSSR, Moscow. Institut

M. I. L'vovich, and A. A. Sokolov. Akademiya Nauk SSSR Vestnik, No 7, p 72-78, July 1971. 4 fig.

Descriptors: \*Hydrologic cycle, \*Water resources, \*Water management (Applied), \*Water balance, Heat balance, Salt balance, Forest management, Land management, Land reclamation, Irrigation, Drainage, Bogs, Erosion control, Pollution abate-ment, Surface waters, Subsurface waters, Groundwater, Streamflow, Runoff, Lysimeters. Identifiers: \*USSR, Irrigated agriculture, Affores-

In their desire to conserve and develop natural resources for future generations, scientists are today faced with the problem of finding valid methods of making long-term forecasts of the consequences which may result from the completion of various land and water management measures aimed at modifying the natural countenance of the earth. Any beneficial transformation of the water balance of an area should, in the final analysis, be reduced to finding a solution to the problem of controlling the water regime rather than simply study ing the possible consequences of already completed measures. This problem will be resolved in the next 5-year plan through the combined ef-forts of scientific and planning institutes of the Hydrometeorological Service, USSR Academy of Sciences, and the Ministries of Geology, Higher and Secondary Specialized Education, Water Resources, Agriculture, Power and Electrification. The purpose of these organizations is to develop methods to evaluate future surface- and subsurmethods to evaluate future surface- and subsurface-water supplies in terms of man's relation to his environment. To this end, it is necessary to coordinate the field, experimental, and laboratory investigations planned. (Josefson-USGS) W72-02778

INFLUENCE OF KARST ON STREAMFLOW IN THE EUROPEAN USSR (VLIYANIYE KARSTA NA STOK REK YEVROPEYSKOY TERRITORII

For primary bibliographic entry see Field 02E. W72-02856

INTERRELATIONSHIP OF GROUNDWATERS AND SURFACE WATERS IN THE LITHUANIAN SSR (VOPROSY YZAIMOSYYAZI PODZEMNYKH I POVERKHNOSTNYKH VOD YUZHNOY PRIBALTIKI).
Institut Geologii. Vilnius (USSR).

Institut Geologii (Vilnius) Trudy, No 10, Izdatel'stvo 'Mintis', Vilnius, 1969. 108 p.

Descriptors: \*Surface-groundwater relationships, \*Surface waters, \*Groundwater, \*Base flow, \*Streamflow, Groundwater basins, Groundwater movement, Groundwater recharge, Groundwater mining, Hydrogeology, Aquifers, Aquifer charac-

## Group 2A-General

teristics, Subsurface waters, Subsurface flow, Water level fluctuations, Hydrographs, Artesian wells, Rivers, Valleys, Model studies. Identifiers: \*USSR, \*Lithuania, Neman River, Variation coefficient, Regionalization.

This collection of 9 papers presents new data on the groundwater resources of the Neman River basin of the Lithuanian SSR and on the ground-water contribution to streamflow. The subjects discussed, in the order of their presentation, are:
(1) subsurface flow of rivers in the Neman River
basin; (2) interrelationship of groundwaters and
surface waters in the Neman River basin; (3) natural groundwater resources and hydrogeological re-gionalization of the Neman River basin; (4) groundwater storage and subsurface flow in the Lithuanian SSR; (5) estimation of subsurface flow in the Neman River basin by hydrochemical means; (6) forecast of potential groundwater storage in river valleys; (7) operation of a well in two water-bearing formations; (8) use of analog models to define potential changes in groundwater storage; and (9) construction and operation of artesian wells in the Lithuanian SSR. Each paper is accompanied by a Russian, Lithuanian, and German summary. (Josefson-USGS)

WATERSHED PHYSICS: MODEL OF THE SOIL MOISTURE CHARACTERISTIC,

Agricultural Research Service, Beltsville, Md. For primary bibliographic entry see Field 02G. W72-02869

## 2B. Precipitation

DATA REQUIREMENTS FOR THE OBJECTIVE ANALYSIS OF GEOSTROPHIC WINDS OVER LAKE ONTARIO,
Northern Illinois Univ., DeKalb, Dept. of Geog-

raphy.

For primary bibliographic entry see Field 02H. W72-02347

REALISTIC RAINFALL SIMULATION FOR

FIELD INVESTIGATION, Arizona Univ., Tucson. Water Resources Research Center.

For primary bibliographic entry see Field 03B. W72-02433

A DIAGRAM FOR DEPICTING THE INTERVEARLY VARIABILITY IN BIOCLIMATIC FACTORS.

Institut Français, Pondichery (India).

V. M. Meher-Homji. Int J Biometeorol, 14 (4): 343-347. Illus, 1970. Identifiers: Bioclimatic, Depicting, Diagram, Variability, Yearly.

In cases of unstable climates like that of Peshawar (West Pakistan) which exhibit variations in rainfall amount, length of distribution and season of occurrence from year to year, averages have little meaning in bioclimatic studies. Range and coefficients of variation are indicated as well as average and median values of annual precipitation, the number of rainy days in the year, the length of the dry season s and the xerothermic index, in order to give an idea of the magnitude of variability. A diagive an idea of the magnitude of variability. A diagram to illustrate the variability in the bioclimatic elements has been designed.—Copyright 1971, Biological Abstracts, Inc. W72-02501

**EVALUATION OF CLOUD SEEDING DEVICES** IN AN OUTDOOR LABORATORY.

Wyoming Univ., Laramie. Natural Resources Research Inst.

Available from NTIS, Springfield, Va. 22151 AD-725 173, \$3.00 paper copy. Wyoming University

Natural Resources Research Institute Final Report, November 1, 1970. 37 p, 21 fig, 3 tab, 10 ref. Naval Weapons Center Contract N66001-70-C-0639.

Descriptors: \*Cloud seeding, \*Weather modifica-tion, \*Ice, \*Crystals, Analytical techniques, Test procedures, Evaluation, Artificial precipitation, Silver iodide, Wyoming, Orography, Clouds, Identifiers: \*Elk Mountain (Wyo).

Artificial ice nuclei generated from Naval Weapons Center pyrotechnic devices and other sources were used to treat the orographic cloud atop Elk Mountain in Wyoming during 1969-70. A summary of these experiments is presented. The data shows the changes in ice crystal concentrations during experimental seeding periods. In most of the cases concentrations increased. Factors considered in analy-sis were distance of the seeding device from the ervatory, the location of the artificial ice nucleus plume relative to the detection point, the residence time of the artificial ice nuclei in the cloud, possible fallout of ice crystals upwind of the Observatory, cloud temperatures, liquid and ice water contents, and artificial ice nucleus output of the seeding devices. (Woodard-USGS) W72-02752

ANALYSIS OF ANTARCTIC ICE CORES.

Cold Regions Research and Engineering Lab., Hanover, N.H. A. J. Gow

Antarctic Journal of the United States, Vol 6, No 5, p 205-206, September-October 1971. 2 fig.

Descriptors: \*Antarctic, \*Ice, \*Drill holes, \*Petrofabrics, Volcanoes, Lava, Petrography, Mineralogy, Analytical techniques, Data collections, Geologic time. Identifiers: Volcanic ash.

Analysis of ice cores from the 2,164-m deep drill hole at Byrd Station, Antarctica, continues at the U.S. Army Cold Regions Research and Engineering Laboratory. Recent research was focused on petrofabric analyses of the ice and petrographic and mineralogical studies of volcanic ash layers preserved in the cores. A total of 25 ash bands and an estimated 2,000 dust bands are preserved in the Byrd ice cores. With the exception of two solitary bands at 911 m and 788 m, the ash-bearing bands are confined entirely to the depth range 1,216 to 2.006 m, which corresponds to the estimated time 2,000 m, while corresponds to the estimated time interval 14,000 to 44,000 years. A period of sustained ash fall occurred during the interval 16,000 to 30,000 years. Correlations with isotopic (paleotemperature) data obtained on the same cores imply that this period of prolonged volcanic activity was accompanied by a significant cooling of the troposphere over Antarctica. (Woodard-USGS) W72-02771

EFFECTS OF CLOUD CONDENSATION NUCLEI DUE TO FIRES AND SURFACE SOURCES DURING SOUTH FLORIDA DROUGHTS,

National Oceanic and Atmospheric Administra-tion, Coral Gables, Fla. Experimental Meteorology Lab

Available from NTIS, Springfield, Va. 22151 COM-71-00723 - \$3.00 paper copy. Journal of Applied Meteorology, Vol 10, No 1, p 62-69, February 1971. 6 fig. 5 tab, 21 ref. Project 404000/21F202072. Bur. Recl. Contract 14-06-

Descriptors: \*Cloud physics, \*Condensation, \*Dropwise condensation, \*Forest fires, Florida, Investigations, Analytical techniques, Clouds, Smoke, Nucleation, Burning, Vegetation, Smoke, Nucleation, Burning, Droughts.

Cloud condensation nuclei (CCN) at cloud base strongly affect the droplet concentration at cloud base, which in turn influences the life history of a cloud. There are usually more nuclei over land than over water because of surface sources of nuclei, and vegetation fires produce large numbers of nuclei which may keep much of a cloud's water in small droplets that fail to reach raindrop size. Smoke particles from drought fires result from the huming of four major vegetation types in South Smoke particles from drought fires result from the burning of four major vegetation types in South Florida. The drought between 1 April and 15 May of 1967 over Florida was related predominantly to synoptic-scale dryness and subsiding northerly winds aloft. There was no significant large-scale lag in rainfall caused by lingering CCN from fires and the dry surface, since dynamic changes explain the onset of normal rainfall. Individual cloud rainfall may have been affected by high CCN counts as in-dicated by cumulus model calculations. Liquid water fallout from small clouds is affected to a greater degree than from tall clouds. (Woodard-USGS) W72-02772

WIND TUNNEL STUDIES OF THE AIR FLOW AND GASEOUS PLUME DIFFUSION IN THE LEADING EDGE AND DOWNSTREAM RE-GIONS OF A MODEL FOREST,

Colorado State Univ., Fort Collins. R. N. Meroney.

Atmos Environ. 4 (6): 597-614. Illus. 1970. Identifiers: Air, Diffusion, Downstream, Edge, Flow, Forest, Gaseous, Leading, Model, Plume, Tunnel, Wind.

A model forest canopy is designed to simulate meteorological characteristics of a typical live forest. Velocity and gaseous plume behavior are measured. Flow properties are compared with recent field measurements. Ground penetration in the initial fetch region resulted in strikingly different streamline motion when compared to wind motions within the equilibrium regions. Measured alues of the vertical eddy diffusion coefficient are shown to predict plume behavior in the equilibrium region if a correction is included for the ratio Ky/KzS1.0. Ventilation of an elevated line source into the canopy region is compared with a simple 1-dimensional mode.--Copyright 1971, Biological Abstracts, Inc. W72-02789

CLIMATIC CONDITIONS IN LOWLAND TROP-ICAL PODZOL AREAS, Max-Planck-Institut fuer Limnologie zu Ploen

(West Germany).

Trop Ecol. 10 (2): 222-239. Illus. 1969. Identifiers: Climatic, Lowland, \*Podzol, Rainfall, Temperature, Tropical.

Climatic conditions of lowland tropical podzol areas are characterized with regard to annual means of rainfall and temperature, duration of humid and arid seasons, and highest and lowest monthly temperatures. By means of monthly and annual water balances 5 climatic phases of lowland tropical podzols are established.—Copyright 1971, Biological Abstracts, Inc. W72-02805

GROUND WATER INVESTIGATION BY RE-SISTIVITY METHOD IN THE DROUGHT AF-FECTED AREA NEAR MARKUNDI DISTRICT

MIRZAPUR (U. P.), Central Arid Zone Research Inst., Jodhpur (India). Sudhir Mohan Pandey. Ann Arid Zone. 9 (2): 77-84. Illus. 1970.

Identifiers: \*Drought, Ground, India, Markundi, Method, Mirzapur, Pradesh, Resistivity, Uttar,

Reconnaissance investigations to locate suitable aquifers were carried out utilizing electrical resistivity methods in Markundi area of Mirzapur district. Wenner's configuration, in particular, was made use of and Tagg's method of interpretation was employed. The depths of interfaces and respective resistivities are given and a comparison was also made from the results obtained by Moore's cu-mulative method of interpretation.--Copyright 1971, Biological Abstracts, Inc. W72-02806

WET AND DRY SPELLS AT NELSPRUIT, Citrus and Subtropical Fruit Research Inst., Nel-spruit (South Africa). G. C. Green.

Agrochemophysica. 1 (2): 43-52. Illus. 1969. Identifiers: Africa, Chain, Dry, \*Markov, Mathematical, Model, Nelspruit, South, Spells, Wet.

This investigation of the occurrence and properties of wet and dry spells was based on a 30-yr record of daily rainfall. Both types of spell are clearly ed. Conclusions were drawn regarding the monthly changes in wet-spell frequency, yield and duration. The first-order Markov chain was shown to be a suitable probability model for wet-spell lengths during the year as a whole and during each summer month excepting Nov. Dry-spell durations are very sensitive to relatively small changes in the termination criteria used in defining a dry spell. Owing to the strong seasonal nature of Nelspruit rainfall, the first-order Markov chain is adequate as a probability model for dry spell durations only during a small part of the wet season.—Copyright 1971, Biological Abstracts, Inc. W72-02815

SOME EVIDENCE OF METEOROLOGICAL RELATED CHARACTERISTICS OF LAKE SUR-FACE TEMPERATURE STRUCTURE,

Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland

For primary bibliographic entry see Field 02H. W72-02879

NUMERICAL SIMULATION OF GREAT LAKES SUMMERTIME CONDUCTION INVERSIONS, Wisconsin Univ., Milwaukee. Dept. of Geography;

and Wisconsin Univ., Milwaukee, Center for Great Lakes Studies.

For primary bibliographic entry see Field 02H. W72-02881

PRECIPITATION, TEMPERATURES, AND VEGETATION IN THE WESTERN ALPS,

Veroff Geobot Inst Ruebel Zurich, 43: 44-58. Illus. Maps. 1970. English summary.

Identifiers: Alps, Precipitation, Temperature, Vegetation, Western.

In the Mediterranean and submediterranean area there are 2 precipitation maxima in early autumn and late winter with a pronounced dry period in summer. Further north and inland, the precipitation curve is smoother with an indistinct minimum in winter, but no dry period during the summer.--Copyright 1971, Biological Abstracts, Inc. W72-02900

NOTE ON PLANT NUTRIENT IN RAIN WATER

AT VARANASI, Banaras Hindu Univ., Varanasi (India). V. K. Agarwal, and G. P. Roy. Indian J Agr Sci. 40 (10): 933-934. 1970. Identifiers: Calcium, India, Nitrogen, Nutrient, Plant, Rain, Varanasi.

The amounts of nitrogen and calcium in mg/l in rain water are given.—Copyright 1971, Biological Abstracts, Inc. W72-02942

## 2C. Snow, Ice, and Frost

THE LONGITUDINAL STRESS AND STRAIN-RATE GRADIENTS IN ICE MASSES, Department of Supply, Melbourne (Australia). An-

tarctic Div. W. F. Budd.

Journal of Glaciology, Vol 9, No 55, p 19-27, February 1970. 1 fig, 13 ref.

Descriptors: \*Glaciers, \*Flow, \*Rheology, Stress, Strain, Mathematical studies, Non-Newtonian flow, Viscosity, Slopes, Topography, Ice, Creep, Shear. Identifiers: Strain rate.

The fundamental equation for the longitudinal The fundamental equation for the longitudinal stress and strain-rate gradient for ice masses with small slope was derived exactly for any slope by Nye, who shows that by using a variable longitudinal axis inclination, parallel to the surface, this equation takes on its simplest form. However for the integration of this equation along the ice mass to obtain stress and strain-rates it is necessary to to obtain stress and strain-rates it is necessary to use a fixed axis direction. In this paper the equation is derived generally for a longitudinal axis of arbitrary inclination, from which the relation between the expressions for the fundamental equation with respect to any longitudinal axis inclination such as parallel to the surface, parallel to the base or horizontal, is readily discerned. An expression for the longitudinal strain-rate is derived to obtain the flow law from longitudinal stress and strain-rate measurements. A single generalized viscosity function is introduced to avoid the complication of both the power flow-law parameters varying with stress. (Knapp-USGS) W72-02281

ICE FLOW OVER BEDROCK PERTURBA-TIONS.

Department of Supply, Melbourne (Australia). Antarctic Div W. F. Budd.

Journal of Glaciology, Vol 9, No 55, p 29-48, February 1970. 3 fig, 35 ref.

Descriptors: \*Glaciers, \*Ice, \*Rheology, \*Shear, \*Flow, Topography, Mathematical studies, Slopes, Stress, Strain, Viscosity, Fourier analysis, Plasticientifiers: Kinematic way

Well known simple periodic solutions of the two-

dimensional biharmonic stress equation can be used for studying the flow over undulations of an ice mass of small surface slope. The model considered is one in which most of the shear takes place near the base and the upper part moves large-ly as a block, with longitudinal strain-rates varying linearly with the longitudinal stress deviations. For bedrock perturbations of a given wavelength the steady-state surface shape consists of similar waves but out of phase such that the steepest slope occurs over the highest bedrock; and the amplitude is over the ingress bettreet, and the amplitude sereduced by a damping factor depending on the speed, viscosity, ice thickness and wavelength. Minimum damping occurs at a wave length of about 3.3 times the ice thickness, while waves much longer or much shorter than this are almost completely damped out. The energy dissipation and the resistance to the ice flow is also a maximum for an undulation scale fo several times the ice thickness, whereas the effects of small basal irregularities die out exponentially with distance into the

ice. As a result of this a revision was made of present glacier sliding theories. Various predictions of the revised theory were confirmed from spectral analysis of surface and bedrock profiles of ice caps. (Knapp-USGS) W72-02282

RADAR SOUNDINGS ON THE PENNY ICE CAP, BAFFIN ISLAND, Department of Energy, Mines and Resources, Ottawa (Ontario).
J. R. Weber, and P. Andrieux.

Journal of Glaciology, Vol 9, No 55, p 49-54, February 1970. 3 fig, 10 ref.

Descriptors: \*Glaciers, \*Sounding, \*Radar, \*Remote sensing, Arctic, Ice, Instrumentation, Seismic studies, Gravity studies, Electrical studies, Surveys. Identifiers: \*Baffin Island, \*Cana

The first successful radar echo soundings through glacier ice in Canada were carried out by the Dominion Observatory in 1965 on an outlet glacier of the Penny Ice Cap in Baffin Island. An unmodified 440 MHz SCR-718 radar altimeter was used; these are readily and inexpensively available on the surplus market. The radar soundings were on the surplus market. The radar soundings were generally in agreement with depths obtained seismically, gravimetrically, and by the electrical resistivity method. The minimum and maximum recorded depths were 45 m and 550 m, respectiverecorded depths were 45 m and 550 m, respectively. The instrument could easily be modified to incorporate a larger oscilloscope with continuous photographic recording. Use of the relatively high carrier frequency of 440 MHz (compared with the more customary frequency of about 35 MHz) allows the use of smaller antennas and results in better resolution of the bedrock surface. (Knapplieges) W72-02283

GENERAL THEORY OF SUBGLACIAL CAVITATION AND SLIDING OF TEMPERA-TURE GLACIERS, Centre National de la Recherche Scientifique,

Grenoble (France). Laboratoire de Glaciologie. L. Lliboutry

Journal of Glaciology, Vol 7, No 49, p 21-58, February 1968. 16 fig, 4 tab, 36 ref.

Descriptors: \*Glaciers, \*Flow, \*Rheology, Friction, Cryology, Pressure, Temperature, Viscosity, Melting, Ice, Water, Alpine, Movement.
Identifiers: Kinematic waves.

Theories of the movement of glaciers are reviewed and compared; they are insufficient to account for the facts observed at the tongue of the Al-lalingletacher, Switzerland. A new theory of the stresses and heat flow at the bed of a glacier with a sinusoidal profile takes account of any degree of subglacial cavitation. The sliding due to plasticity and that due to pressure melting are related to the degree of cavitation; it is shown that these two terms are additive. An expression is given for the terms are additive. An expression is given for the friction in terms of the total sliding velocity and the height of the bumps. For a given and large enough value of velocity, friction exhibits two maxima which are equal and independent of velocity. A more realistic model of the bed consists of a superposition of sine waves all having the same roughness, and bed topography decreases in a geometrical progression. The resulting frictional force can be regarded either as part of the total frictional force in an overall view, or else as a correction to such a value on the small scale (the best point of view for crevasse studies). To a first ap-proximation Coulomb's law of friction holds, provided the interstitial water pressure at the ice-rock interface is accounted. If the subglacial hydraulic system is at atmospheric pressure interstitial pressure is proportional to thickness of the glacier. If the sliding velocity is not too large, the surface slope approaches 0.12 and kinematic waves (which stope approaches U.12 and kinematic waves (which move four times as fast as the ice) disappear rapidly. If the hydraulic system is not at atmospheric pressure the surface slope is smaller and flow instabilities can occur. (Knapp-USGS) W72-02284

SNOW ACCUMULATION STUDIES ON THE

THULE PENINSULA, GREENLAND, Cold Regions Research and Engineering Lab., Hanover, N.H. S. J. Mock.

Journal of Glaciology, Vol 7, No 49, p 59-76, February 1968. 12 fig, 3 tab, 31 ref.

## Group 2C-Snow, Ice, and Frost

Descriptors: \*Snowfall, \*Regimen, \*Glaciers, \*Arctic, Movement, Glaciation, Water balance, Topography, Model studies, Climatology, Rheology, Surveys, Isohyets. Identifiers: \*Greenland, \*Camp Century, Thule.

Data from stake measurements, marker boards and pits along a 136 km trail crossing the Thule peninsula sector of the Greenland ice sheet were used to determine both the regional and local distribution of snow accumulation. On a regional scale, trend or snow accumulation. On a regional scale, trends surfaces of mean annual accumulation can be predicted from a model using distance from moisture source and elevation as independent parameters. A series of step- or wave-like features break the smooth profile of the ice sheet and cause profound local changes in accumulation rates. The accumulation pattern over these features can be predicted from surface slope and departure from regional elevation. Profiles of surface and subsurface topography indicate a direct relationship between sub-surface hills and step-like features, but cannot be quantitatively accounted for by existing ice-flow theory. Detailed accumulation studies in conjunction with a program of spirit leveling in the vicinity of Camp Century reveals a shallow valley-like fea-ture. Within this feature accumulation rates have increased indicating that it is the result of flow phenomena. (Knapp-USGS) W72-02285

RECENT GLACIAL HISTORY OF AN ALPINE AREA IN THE COLORADO FRONT RANGE, U.S.A.: II. DATING THE GLACIAL DEPOSITS, Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.

J. B. Benedict. Journal of Glaciology, Vol 7, No 49, p 77-87, February 1968. 7 fig, 17 ref.

Descriptors: \*Glaciation, \*Colorado, \*Pleistocene epoch, \*Alpine, \*Dating, Lichens, Glacial drift, Glaciers, Till, Radioactive dating. Identifiers: Lichenometric dating.

Recent glacial deposits in the Indian Peaks area of the Colorado Front Range were dated lichenometrically, using a growth curve developed locally for Rhizocarpon geographicum. Radiocarbon dates, where available, tend to support the lichen chronology. Three distinct intervals of glaciation, each consisting of several minor pulsations, have occurred in the area during the past 4500 years. The earliest advance (Temple Lake Stade) is dated at 2500-700 B.C. A later advance (Arikaree State) began in about A.D. 100 and ended in A.D. 1000. The most recent advance (Gannett Peak Stade) is dated at A.D. 1650-1850. Whether the Arikaree Stade was purely a local development or whether glaciers were advancing elsewhere in the cordilleran region during this interval was not determined. Alluviation on the plains east of the Colorado Front Range probably occurred during the waning stages of mountain glaciation. (Knapp-HSGS)

FIELD MEASUREMENTS OF DIELECTRIC AB-SORPTION IN ANTARCTIC ICE AND SNOW AT VERY HIGH FREQUENCIES,

Scott Polar Research Inst., Cambridge (England); and British Antarctic Survey, London (England). M. E. R. Walford.

Journal of Glaciology, Vol 7, No 49, p 89-94, February 1968. 2 fig, 22 ref.

Descriptors: \*Sea ice, \*Radio waves, \*Electromag-Descriptors: "Sea ice, "Radio waves, "Electromag-netic waves, "Electrical properties, \*Attenuation, Absorption, Instrumentation, Electrical studies, Conductivity, Resistivity, Sounding, Water chemis-try, Electrochemistry. Identifiers: \*Dielectric absorption.

Field measurements were made of dielectric absorption in Antaractic snow and ice at frequencies of a few hundred megahertz and compared with measurements at very high frequencies. Dielectric absorption in ice is accounted for in terms of abassorption bands both at radio frequencies and in the infra-red. Bands at radio frequencies are caused by a relaxation mechanism which depends upon the temperature and the impurity content of the ice. These two factors are therefore included in an analysis of the dielectric absorption in ice at very high frequencies (Neona 1868). frequencies. (Knapp-USGS) W72-02287

HEXAGONAL AND CUBIC ICE AT LOW TEM-PERATURES,

Cold Regions Research and Engineering Lab., Hanover, N.H.

Journal of Glaciology, Vol 7, No 49, p 95-108, February 1968. 7 fig, 6 tab, 23 ref.

Descriptors: \*Ice, \*Cryology, \*Crystallography, \*Temperature, Physical properties, Supercooling, Thermal properties, Sublimation, Condensation, Crystal growth, Water vapor, Microscopy.

The formation of hexagonal and cubic forms of ice was studied by the use of a cold stage in an electron microscope within the temperature range -90 deg to -180 deg C. Ice crystal specimens were made o cold substrates including collodion film, gold foil, or copper grid on the specimen holder of the cold stage. The hexagonal form of ice formed on the cold substrates at temperatures from -90 deg to -100 deg C. At -100 deg to -130 deg C, both hexagonal and cubic forms of ice were detected. From -130 deg to -160 deg C only cubic ice was found. At temperatures below -160 deg C, minute crystals of cubic ice were detected. No transformation of the structural form of ice from hexagonal to cubic or from cubic to hexagonal occurred when the temperature of the specimens was varied in the range - 90 deg to -160 deg C. The lattice constants of hexagonal and cubic ice, and the coefficient of thermal expansion of ice were calculated from the experiental results. (Knapp-USGS) W72-02288

AN AUTOMATIC GAUGE FOR MEASURING SEA-ICE THICKNESS,

Melbourne Univ., Victoria (Australia). Dept. of Meteorology.

Peter Schwerdtfeger.

Journal of Glaciology, Vol 7, No 49, p 109-113,
February 1968. 3 fig, 5 ref.

Descriptors: \*Sea ice, \*Measurement, \*Instrumentation, \*Data collections, Telemetry, Boreholes. Identifiers: Sea ice thickness.

A device is described which automatically measures the thickness of a floating ice cover at regular or any desired times and allows the result to be printed together with the time on a shore-based recorder. This instrument has been proven by a year's operation near Mawson, Antarctica. The apparatus consists of a metal flange attached to a stable resistance wire through a vertical bore hole in the ice. The wire can be drawn up until the attached metal flange reaches the ice-water interface. The ice thickness is observed by recording the length of wire exposed at the surface. (Knapp-W72-02289

THE FORMATION AND SHAPE OF DRUMLINS AND THEIR DISTRIBUTION AND ORIENTA-TION IN DRUMLIN FIELDS.

University Coll., London (England). I. J. Smalley, and D. J. Unwin. Journal of Glaciology, Vol 7, No 51, p 377-390, October 1968. 7 fig, 1 tab, 28 ref.

Descriptors: \*Till, \*Glacial drift, \*Clays, \*Deposition (Sediments), Geomorphology, Land forming, Topography, Glaciers, Shear, Movement. Identifiers: \*Drumlins.

If glacial till contains more than a certain minimum If glacial till contains more than a certain minimum boulder content, it is dilatant and requires a much larger stress to initiate shear deformation than to sustain it. If the stress level at the glacier-terrain interface drops below a certain critical level, or the till reaches its critical boulder-content density, then the till beneath the glacier packs into stable obstructions. These are shaped into streamlined forms by the glacier and are found distributed at random in drumlin fields. Due to drumlin coalescence there is a normal distribution of drumlin axes about the is a normal distribution of drumlin axes about the direction of ice movement. The bulk of transported arrection or ice movement. The bulk of transported till may be carried within the ice sheet; for drumlins to form there must be shear deformation in till at the glacier-terrain interface. This may require the ice to be advancing over already deposited till. (K-napp. 1855) napp-USGS) W72-02290

HARDNESS ANISOTROPY OF CRYSTALS IN ICE IH, HARDNESS SINGLE CRYSTALS IN ICE III, Cambridge Univ. (England). Cavendish Lab. E. L. Offenbacher, and I. C. Roselman. Nature Physical Science, Vol 234, No 49, p 112-113, December 6, 1971. 2 fig, 4 ref.

Descriptors: \*Anisotropy, \*Crystals, \*Ice, \*Crystallography, Physical properties, Analytical techniques, Freezing, Temperature, Testing. Identifiers: \*Knoop hardness (crystals).

Knoop hardness measurements were made at four knoop hardness measurements were made at one temperatures (-5.0 deg C, -7.5 deg C, -10.0 deg C and -12.5 deg C) on the prismatic and basal planes of the single crystals of ice. The crystal was rotated through 15 deg intervals and at least five indentations were made at each angle. The spread in individual values at the higher temperatures was only slightly less than the anisotropy being studied. Directions on the prismatic plane could be deter-mined optically and by examination of thermal etch pits, but angles on the basal plane had to be measured relative to an arbitrary zero as no X-ray mea-surements were practicable. Measurements on the prismatic plane showed a 30 to 40% anisotropy in the Knoop hardness. The hardest direction is perpendicular to the c-axis and the softest lies between 30 deg and 45 deg to the c-axis. Results were less definitive on the basal plane but a 10 to 15% anisotropy could be detected with three maxima and two minima occuring in an angular range of 120 deg. (Woodard-USGS)
W72-02302

A FLAT ELECTRICAL CAPACITANCE SEN-SOR FOR REMOTE STUDIES OF ICE JAMS UNDER SEVERE ICE CONDITIONS (PLOSKIY ELEKTROYEMKOSTNYY DATCHIK DLYA DISTANTSIONNOGO ISSLEDOVANIYA ZAZ-HOROV V TYAZHELYKH LEDOVYKH USLOVIYAKH), All. Inion

All-Union Designing, Surveying, and Scientific Research Inst. Hydroproject, Moscow (USSR). Yu. M. Romanenko.

Meteorologiya i Gidrologiya, No 4, p 99-105, April 1971. 1 fig, 12 ref.

Descriptors: \*Electrical equipment, \*Instrumenta-tion, \*Measurement, \*Ice jams, \*Frazil ice, Ther-modynamics, Strength of materials, Deformation, Electric cables, Design data. Identifiers: \*USSR, \*Sensors, \*Slush ice, Ice con-

centration. Ice inclusions.

The design of a flat electrical capacitance sensor for determining the concentration of frazil ice in ice jams under severe ice conditions was examined to establish procedures for selecting, calculating, and controlling the parameters of individual struc-tural elements of the sensor. On the basis of tests run on the sensor at the end of 1963 at the Ice Thermal Laboratory of the Leningrad State Hydrologic Institute, the flat sensor is preferred to the coaxial sensor in investigating ice jams with in-clusions of broken ice, and particularly in determining the zone of frazil-ice occurrence in ice jams where the ice concentration is 40-60%. (JosefsonW72-02313

ICE LENSES IN THE EASTERN PART OF THE ICE LENSES IN THE EASTERN PART OF THE SELENNYAKH RANGE AND UYANDINA DEPRESSION, THEIR FORMATION CHARACTERISTICS AND IMPORTANCE FOR EVALUATING GROUNDWATER RESOURCES (NALEDI VOSTOCHNOY CHASTI SELENNYAKHSKOGO KHREBTA I UYANDIN SKOY VPADINY, OSOBENNOSTI IKH FORMIROVANIYA I OTSENKA PO NIM RESURSOV POSZEMNYKH VOD), Moscow State Univ. (USSR). Chair of Permafrost Study.

V. Ye. Afanasenko, N. N. Romanovskiy, V. N.

Vestnik Moskovskogo Universiteta, Seriya 4, Geologiya, No 3, p 81-93, May-June 1971. 4 fig, 2 tab, 7 ref.

Descriptors: \*lce, \*Permafrost, \*Frozen ground, \*Groundwater, Hydrogeology, Aquifers, Structural geology, Orography, Geologic time, Infiltration, Channels, Flood plains, Springs, Gases, Thawing,

Identifiers: \*USSR, \*Yakutsk ASSR, \*Ice lenses, Tectonics, Mineralization, Regionalization.

The area of the Selennyakh Range and Uyandina Depression is located in the western part of the Verkhoyansk-Chukot fold mountains in northeast Yakutsk ASSR. Three hydrogeological structures were distinguished in the area: (1) the Selennyakh cryogenic massif; (2) the Polousnensk-Tuostakh cryogenic massif; and (3) the Uyandina post-artesian cryogenic basin. Five types of taliks (thawed areas within the Permafrost) were identified: (1) opaque underchannel and floodplain, fed by infil-tration; (2) opaque sublacustrin; (3) transparent underchannel, fed by infiltration and flow of water through openings in the earth's crust; (4) transparent underchannel and floodplain under artesian pressure; and (5) transparent hydrogeogenous under artesian pressure. Ice lenses of the area were under artesian pressure, ice lenses of the area were divided into four groups: (1) ice lenses fed by alluvial waters of opaque underchannel and floodplain taliks; (2) ice lenses fed by underchannel alluvial waters and by groundwaters of Paleozoic aquifers; (3) ice lenses fed exclusively by groundwaters of Paleozoic aquifers; and (4) ice lenses fed either by underchannel alluvial waters and groundwaters of Paleozoic aquifers or exclusively by groundwaters of Paleozoic aquifers. The formation and growth of ice lenses of alluvial waters are associated with groundwaters of opaque underchannel and flood-plain taliks. (Josefson-USGS) W72-02316

PHYSICAL AND TECHNICAL INVESTIGA-TIONS OF ICE (FIZIKO-TEKHNICHESKIYE ISSLEDOVANIYA L'DA), Arkticheskii i Anarkticheskii Nauchno-Iss-ledovatelskii Institut, Leningrad (USSR).

G. N. Yakovlev.

Arkticheskiy i Antarkticheskiy Nauchno-Issledovatel'skiy Institut Trudy, No 300, Leningrad, 1971. 220 p.

Descriptors: \*Cryology, \*Ice, \*Sea ice, Lake ice, Ice loads, Crystals, Mechanical properties, Physical properties, Pressure, Stability, Deformation, Densiy, Temperature, Salinity, Freezing, Melting, Seasonal, Arctic Ocean, Antarctic Ocean, Hydrau-

Seasonal, rice ocean, rinarctic coean, riyanalic structures. Identifiers: \*USSR, \*Glaciology, Ice cover, Ice properties, Ice structure, Ice control, Ice movement, Ice formation, Ice drift, Ice breakers.

This collection of 21 papers is devoted to recent field and laboratory investigations of ice in its various aspects, including the structure and properties of ice, its occurrence and movement, and methods of ice-cover destruction and ice-damage control. A number of papers discuss the results of research on the physical and mechanical properties of ice in the Arctic and Antarctic. The book is designed to acquaint glaciologists, hydraulic engineers, hydrologists, and engineers of allied disciplines

with the scientific aspect of the subject as well as with its engineering applications. (Josefson-USGS) W72-02317

DIURNAL GEOCHEMISTRY OF CANOPUS POND, WRIGHT VALLEY, 1969-1970, Ohio State Univ., Columbus. Inst. of Polar Studies. For primary bibliographic entry see Field 02H. W72-02332

STUDIES ON THE ACTINOMYCETES FOUND IN THE OOZE OF SOME GLACIAL LAKES, (IN

For primary bibliographic entry see Field 021. W72-02505

SEASONAL VARIATION IN THE NUMBER OF ZOOPLANKTON IN THE NORTH POLE RE-

Akademiya Nauk SSSR, Leningard. Zoologicheskii Institut.

Dokl Akad Nauk SSSR Ser Biol. 196 (2): 441-444. Illus. 1971.

Identifiers: Abundance, North, Number, Plankton, Pole. Seasonal.

Data are given on the vertical distribution of zooplankton and its changes during the year near the North Pole. Their average number in different water masses was calculated on the basis of 150 samples for each water mass. The maximum number of zooplankton occurs in Aug. -- Copyright 1971, Biological Abstracts, Inc. W72-02551

GUIDELINES FOR SAMPLING AREA-MEAN WATER EQUIVALENT IN FORESTED WATERSHEDS.

Rocky Mountain Forest and Range Experiment

Station, Fort Collins, Colo. C. F. Leaf, and J. L. Kovner.

In: Proceedings of Hydrology Seminar, University of Wyoming, May 20-21, 1971; Laramie, Wyoming University Water Resources Research Institute Report, p 161-167, 1971. 3 tab, 3 ref.

Descriptors: \*Snow surveys, Hydrology, \*Snow cover, \*Water equivalent, \*Forests, \*Colorado, Hydrologic data, Data collections, Sampling, Methodology, Analytical techniques, Statistical analysis, Water yield, Watershed management, Forestry, Transpiration.

Statistical analyses were made of snow course measurements on a 714-acre (Fool Creek) watershed in the Fraser Experimental Forest near Fraser, Colorado. The most efficient snow course sampling scheme for measuring winter snow accumulation on uniformly forested small watersheds in central Colorado involves: (1) sampling zones that are stratified according to elevation with proportional sampling in each zone; (2) sampling points that are widely spaced over each zone with at least two duplicate measurements at a location. On the watershed studied, 12 samples were taken along each of 32 snow courses. Two important considera tions in snow surveys are emphasized. First, the seasonal snowpack accumulates in a systematic and not a random fashion on mountain watersheds. Thus, correlation significantly reduces the error in the estimate of the average water equivalent between two points. Secondly, if only a small part of a watershed is sampled, the relative error of the mean increases as the area sampled decreases--no matter how intensively sampled. The implication is that extrapolation of data from small index snow courses to obtain area-mean water equivalent should be avoided. Snow course data are tabulated. (Woodard-USGS)
W72-02746 GLACIER INVENTORY OF CANADA-AXEL HEIBERG ISLAND, NORTH WEST TERRITO-

Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Water Branch. C. S. L. Ommanney.

Canada Department of Energy, Mines and Resources Inland Waters Branch Technical Bul-letin No 37, 1969. 97 p, 33 fig, 5 map, 14 tab, 253

Descriptors: \*Glaciers, \*Documentation, \*Hydrologic data, \*Reviews, Ablation, Climatology, Glacial drift, Geomorphology, Glaciation, Information retrieval formation retrieval.
Identifiers: \*Glaciers (Canada).

Axel Heiberg Island (80 deg N, 90 deg W) was used as a pilot study for the first Canadian glacier inventory report for the International Hydrological Decade. The ISLAND HAS 1121 glaciers which cover 11,735 sq. km (31% of the land area.) The glaciers have an estimated volume of 3,222 cubic km of ice. Basic data for each glacier are presented as a computer printout and referenced to a set of index maps. Details of the physiography, climate and history of the island, as well as a bibliography containing 253 entries, are included. (Woodard-USGS) W72-02750

EVALUATION OF CLOUD SEEDING DEVICES IN AN OUTDOOR LABORATORY.

Wyoming Univ., Laramie. Natural Resources Research Inst. For primary bibliographic entry see Field 02B. W72-02752

INTERFERENCE PHENOMENA IN DEFORMED SINGLE CRYSTALS OF ICE, British Meteorological Office, Bracknell (En-

gland). C. J. Readings, and J. T. Bartlett. Journal of Glaciology, Vol 10, No 59, p 269-286, 1971. 11 fig, 1 tab, 12 ref.

Descriptors: \*Deformation, \*Ice, \*Crystallography, \*Cryology, Anisotropy, Crystallization, Refractivity, Plastic deformation, Shear, Flow, Rheology. Identifiers: Ice-crystal deformation.

Rectangular single crystals of ice subjected to uniaxial compression parallel to their long axes and viewed between crossed polarizers often showed interference fringes. Some of these interference bands were associated with grain boundaries formed as a result of kinking. These can be explained in terms of the known anisotropic optical properties of ice and the change in the orientation of the optic axis across the boundary. Other interference bands were parallel to the trace of the basal plane on the surface of some deformed crystals. These bands are a result of slight random misorientations between adjacent slip lamellae. The required misorientations are of the order of 1 deg. Dislocations with nonbasal Burgers vectors probably make an active contribution to the deformation. (Knapp-USGS) W72-02766

ON THE PLEISTOCENE SNOW-LINE DEPRES-SION IN THE ARID REGIONS OF THE SOUTH AMERICAN ANDES,

Wisconsin Univ., Madison. Dept. of Meteorology. S. L. Hastenrath.

Journal of Glaciology, Vol 10, No 59, p 255-267, 1971. 10 fig, 30 ref.

Descriptors: \*Paleoclimatology, \*Pleistocene epoch, \*Mountains, Snowpacks, Alpine, Air circulation, Atmospheric physics, Snow cover, Glaciers, Glaciation, Arid lands.
Identifiers: \*Andes, \*Snow lines.

## Group 2C-Snow, Ice, and Frost

ield observations during a journey through the arid regions of the South American Andes in June-July 1969 were used with available air photographs and reports from adjacent regions of the High Andes to find Pleistocene snow lines. The snow lines were depressed in the western Cordillera from about 700 m at lat. 12 deg S. to more than 1,500 m at lat. 30 deg S. The Pleistocene snow-line depression decreases from the Pacific to the Atlantic side of the Andes, but particularly strongly on the poleward fringe of the arid region. From this geomorphic evidence it is suggested that the atmospheric circulation during the glacial period was racterized by an Equatorward displacement of the boundary between tropical easterlies and tem-perate-latitude westerlies. (Knapp-USGS) W72-02767

GRAVITY MEASUREMENTS ON **FOX** GLACIER', YUKON TERRITORY, CANADA, British Columbia Univ., Vancouver. Dept. of Geophysics.
D. J. Crossley, and G. K. C. Clarke.

Journal of Glaciology, Vol 9, No 57, p 363-374, October 1970. 9 fig, 9 ref, append.

Descriptors: \*Glaciers, \*Surveys, \*Gravity studies, Sounding, Profiles, Water balance, Temperature, eismic studies. Identifiers: Fox Glacier (Canada).

'Fox Glacier', Yukon Territory, has a history of surging and is at present in a quiescent period. In 1968 a gravity survey was carried out over the glacier, in order to find ice depths. The glacier is thin with a maximum depth of 88 m. The data are presented in tables, maps, and profiles. (Knapp-USGS) W72-02768

AN INVENTORY OF THE PRESENT AND PAST GLACIERIZATION OF HOME BAY AND OKOA BAY, EAST BAFFIN ISLAND, N.W.T., CANADA, AND SOME CLIMATIC AND PALEOCLIMATIC CONSIDERATIONS.

Colorado Univ., Boulder. Inst. of Arctic and Alpine

J. T. Andrews, R. G. Barry, and L. Drapier. Journal of Glaciology, Vol 9, No 57, p 337-362, 1970. 15 fig, 9 tab, 38 ref.

Descriptors: \*Glaciation, \*Climatology, \*Synoptic analysis, Arctic, Glaciers, Regimen, Aerial photography, Surveys, Data collections, Paleoclimatology. Identifiers: Baffin Island (Canada).

An air-photograph inventory was made of the present glacierization of areas of east Baffin Island adjoining Home Bay and Okoa Bay. Ice fields characterize the broad mountain summits of Home Bay, while Okoa Bay is an area of circue glaciers. There is a 4:1 ratio of ice-covered areas between Home Bay and Okoa Bay above 600 m a.s.l. In Okoa Bay 39% of empty cirques face south, whereas those with existing glaciers are restricted to orientations with azimuths between 310 deg -145 deg. Neither glacier length nor the observable recession in the Home Bay area show any significant difference with regard to aspect. Climatic parameters (snowfall and degree days) and synop-tic-climatological studies do not explain the strong contrast between the two areas. Cool, cloudy summer conditions are associated with easterly flow components that should affect both areas. Differential lag effects between the ice bodies in the two areas may be responsible for some of the observed difference. (Knapp-USGS)

ANALYSIS OF ANTARCTIC ICE CORES, Cold Regions Research and Engineering Lab., Hanover, N.H. For primary bibliographic entry see Field 02B. W72-02771

HYDROLOGIC CHARACTERISTICS OF ICE JAM FORMATION ON THE LOVAT' RIVER (NEKOTORYYE GIDROLOGICHESKIYE OBENNOSTI ZATOROOBRAZOVANIYA NA

Leningrad State Univ. (USSR).

M. G. Sofer.
Vestnik Leningradskogo Universiteta, Seriya 12,
Geologiya i Geografiya, No 2, p 104-110, June
1970. 3 fig, 1 tab, 6 ref.

Descriptors: \*Ice, \*Ice jams, \*Ice breakup, Melting, Water level fluctuations, Slopes, Gaging stations, Frequency analysis.
Identifiers: \*European USSR, \*Lovat' River, Lake

Il'men, Ice movement, Ice flow.

One of the principal causes of ice jams in most rivers of the northwestern part of the European USSR is their predominant direction of flow from SSR is their predominant direction of flow, considerable length (536 km), and sharp changes of slope, the Lovat' River is a typical ice-jam river and, hence, ideal for studying the general patterns and, hence, ideal for studying the general patterns of ice jam formation on rivers of the Northwest. A definite pattern in the frequency of ice jams along the river was observed. Ice jams reached their maximum development in the middle. imum development in the middle reach of the Lovat' between Sel'tso and Kholm and decreased in the downstream reach toward Vzvad. The characteristics of ice iam formation on the Lovat River may be used as a basis for more extensive investigations on other rivers of the Northwest. These investigations will help to compile cartograms of the frequency of ice jams in rivers of the area and to determine the reaches and cross sections where ice jam processes are most strongly developed. (Josefson-USGS) W72-02777

DESIGN FOR OPTIMUM WAVE CONDITIONS, CRESCENT CITY HARBOR, CRESCENT CITY, CALIFORNIA: HYDRAULIC MODES IN-VESTIGATION.

Waterways Experiment Station, Army Engineer For primary bibliographic entry see Field 08B. W72-02826

NEW DATA ON SEDIMENT FORMATION IN THE WHITE SEA IN THE LATE POSTGLA-CIAL PERIOD (NOVYYE DANNYYE OB OSAD KOOBRAZOVANII V BELOM MORE V POZD-NEPOSLELEDNIKOVOYE VREMYA), Akademiya Nauk SSSR, Moscow. Institut Oke-

anologii. For primary bibliographic entry see Field 02J. W72-02859

SNOW DISTRIBUTION IN RELATION TO SOLAR RADIATION ON TWO SWISS PRE-ALP

WATERSHEDS, Colorado State Univ., Fort Collins J. R. Meiman, E. Remmenga, and H. Keller. Water Resources Research, Vol 7, No 6, p 1636-1640, December 1971. 1 fig, 2 tab, 6 ref.

Descriptors: \*Snowpacks, \*Solar radiation, \*Water equivalent, \*Ablation, Snow cover, Snow surveys, Distribution patterns, Snowfall, Heat budget, Meteorological data, Data collections, Alpine. Identifiers: Switzerland, Alps.

The differences in the water equivalent of snow on 15 transects in Switzerland at mid-March were closely related to estimated differences in potential beam radiation. Only slight improvement results from refining the radiation estimates to ac-count for shading, clouds, and diffuse and reflected radiation. For 1967-1969, 79% of the variance was associated with estimated global radiation. Estimates of solar radiation can be useful for extrapolating snowpack water equivalent measure-ments over watersheds in which differential ablation is the chief cause of areal variation. (Knapp-W72-02872

THE ROLE OF THE WARM-WATER COM-PLEX OF THE WARM-WATER COM-PERIOD UNDER THE ICE AT SOME IVANO-ARAKHLEISK LAKES, For primary bibliographic entry see Field 02H. W72-02891

UNIQUE CONDITION UNDER THE ICE OF LAKES OF THE TRANSBAIKAL AND THEIR ROLE IN INCREASING BIOLOGICAL PRODUCTIVITY, For primary bibliographic entry see Field 02H. W72-02892

METHOD OF CALCULATING PRIMARY PRODUCTION AND DESTRUCTION IN LAKES DURING THE ICE PERIOD. For primary bibliographic entry see Field 02H. W72-02893

## 2D. Evaporation and Transpiration

EVAPORATION FROM LAKE AND LAND PANS AT THE U.S. ARMY ENGINEER WATER-WAYS EXPERIMENT STATION, JANUARY 1941 THROUGH DECEMBER 1945, Army Waterways Experiment Station, Vicksburg, Miss.

R. G. Cox

Available from NTIS, Springfield, Va., 22151 as AD-724 535, \$3.00 in paper copy, \$0.95 in microfiche. Army Corps of Engineers Waterways Experiment Station Miscellaneous Paper H-68-4, October 1968. 55 p, 23 plate, 12 photo, append.

Descriptors: \*Evaporation, \*Evaporation pans, \*Lakes, \*Land, \*Hydrologic data, Data collections, Analytical techniques, Water level fluctuations, Winds, Climatology, Meteorological data, Investigations, On-site investigations. Identifiers: Evaporation experiments

During the period January 1941 through Decemb 1946 evaporation mearurements were made at lake and land evaporation stations established at the U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. These stations were of the U.S. Weather Bureau Class A type modified during the test period to meet the needs of specific short-term objectives without jeopardizing the long-term program results. The results of the study are sum-marized in tables and plates. The data indicate that evaporation from the land station was 80% of that from the floating lake station. This difference is at-tributed to the fact that the average wind speed at the land station was less than 50% of that at the lake station. Normally, the evaporation from a lake station is appreciably less than that from a com-parable land station. Careful measurement of lake surface elevation changes, and dam seepage during periods of negligible lake inflow and light rainfall, perious or negligible take inflow and light rainfall, showed that evaporation from the lake water surface averaged 75% of that measured at the floating pan during a specifically selected time period. The extreme variations were 56.7% and 92.3%. (Woodard-USGS) W72-02326

PHYSIOLOGICAL RESPONSES OF SORGHUM AND MAIZE LEAVES TO WATER STRESS: III.
TRANSPIRATION RESPONSES OF CUT
LEAVES IN DESICCATION EXPERIMENTS (IN SPANISH), Instituto de Edafologia y Biologia Vegetal, Madrid

For primary bibliographic entry see Field 03F. W72-02539

COMPARATIVE STUDY ABOUT THE RATE OF TRANSPIRATION OF SOME PLANT SPECIES FROM PLANT SOCIETIES, FIELDS AND FRUIT ORCHARDS, (IN CROATIAN), Mihovil Gracanin, Ljudevit Ilijanic, Valentina Gazi-Baskova, and Nada Hulina.

## Streamflow and Runoff—Group 2E

Acta Bot Croat. 29: 113-129. 1970. German sum-

mary.
Identifiers: Apple-D, Betula-Pendula-D, Carpinus-Betulus-D, Corylus-Avellana-D, Fagus-Sylvatica-D, Fields, Fruit, Orchards, Parative, Plant, Quercus-Petraea-D, Quercus-Robur-D, Rate, Societies, Species, Transpiration, Yugoslavia, Zea-Mays-M.

The transpiration rate of Quercus robur, Q. petraea, Carpinus betulus, Fagus sylvatica, Corylus aveilana and Betula pendula on diluvial soil teraces near Zagreb calculated per unit of leaf surface, fluctuated in the summer of 1968 from 0.60 face, fluctuated in the summer of 1968 from 0.60 to 1.20 mg/dm sq/hr while the transpiration of Red Delicious' and 'Jonathan' apple cultivars was form 6.15 to 6.95 mg/dm sq/hr. Transpiration rate increased in the order Fagus, Carpinus, Q. petraea, Corylus, and Q. robur. Phanerophytes at Bozjakovina transpired less than Zea mays on an adjacent field. The water consumption of phanerophytes fluctuated from 0.67-3.41 of their leaf weight that of apple from 2.19-2.68 of leaf weight the rate was limited by genetic factors and by rhizosphere humidity.—Copyright 1971, Biological Abstracts, Inc. W72-02575

RELATIONSHIP BETWEEN EVAPOTRANSPIRATION OF RICE AND PAN EVAPORATION,

University of Agriculture, Godollo (Hungary). Dept. of Crop Prod. and Soil Cultivation. V. K. Vamadevan.

Acta Agron Acad Sci Hung. 20 (1/2): 117-121. Il-

lus. 1971. (Russ. summ.). Identifiers: Evapo, Evaporation, Pan, Relationship, Rice-M, Transpiration.

A 2-yr study of the relationship between evapotranspiration (ET) and pan evaporation (E) (Class 'A' pan and GGI 3000 pan) indicates that the ratio of ET/E is almost constant for the vegetative, reproductive and ripening stages of rice growth. A monthly and seasonal ratio of '1' is recommended for areas with conditions similar to recommended for areas with conditions similar to those in the experiment. There was no significant difference between Class 'A' pan and GGI 3000.— Copyright 1971, Biological Abstracts, Inc. W72-02699

FIELD MEASUREMENT OF PAN EVAPORA-TION,

Montana Agricultural Experiment Station,

James R. Sims, and G. D. Jackson.

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Agron J. 63 (2): 339-340. Illus. 1971. Identifiers: \*Evaporation, Field, Measurement,

An inexpensive method for measuring pan evaporation at off-station sites was developed. Evaporation measured by the new method was sig-nificantly correlated (1% level) with evaporation measured with a standard USA Weather Bureau class A evaporation pan.—Copyright 1971, Biological Abstracts, Inc.
W72-02731

GUIDELINES FOR SAMPLING AREA-MEAN WATER EQUIVALENT IN FORESTED WATERSHEDS,

Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo. For primary bibliographic entry see Field 02C. W72-02746

PLUVIOMETRIC QUOTIENTS AND BIO-SPHERIC DEGRADATION: SOME THOUGHTS, ingenieur Eaux, Forets, Algiers (Algeria).

P. Stewart. Bull Soc Hist Natur Afr Nord. 59 (1-4): 23-36.

Identifiers: Biospheric, Degradation, Evapo, \*Pluviometric, Quotients, Thoughts, Transpiration.

The numerator and denominator of pluviometric quotients correspond roughly with actual and potential evapo-transpiration. Simplified formulae for the quotients of Emberger and Calvet show that they differ essentially in the temperature function used in the numerator. The simplest formula gives practically the same result for Algeria as the most complex, although theoretical considerations suggest that the latter should be better. A study of the effect of degradation of the biosphere on biocligest that the latter should be better. A study of the effect of degradation of the biosphere on bioclimate shows that the quotients cannot be unmodified to compare degraded with climax situations.—Copyright 1971, Biological Abstracts, Inc. W72-02804

THE EFFECT OF AIR TEMPERATURE AND MOISTURE STRESS UPON LEAF SURFACE TEMPERATURES OF CALOTROPIS PROCERA

(WILLD.) R. BR., Volcani Inst. of Agricultural Research, Ilanot

(Israel). Forestry Div. Rene Karschon, and Lydia Pinchas. Oecol Plant. 6 (1): 43-49. Illus. 1971. French and

German summary.
Identifiers: Air, Calotropis-Procera-D, Leaf,
Moisture, Stress, Surface, Temperature, Temperatures. Transpiration.

In the absence of moisture stress, leaf surface tem-peratures in C. procera were controlled by meteorological factors which determined the magnitude of the transpiration rate. Under conditions of moisture stress the leaf temperatures were related to the hydration of the plant.—Copyright 1971, Biological Abstracts, Inc. W72-02809

THE REACTION RATE OF STOMATA OF LEAVES EXPOSED TO LIGHT AFTER A DARK

Institut Pasteur, Paris (France). Laboratoire de Chimie Theoretique.

Joseph Sivadjian. C R Hebd Seances Acad Sci Ser D Sci Natur Paris. 272 (4): 561-563. Illus. 1971.

Identifiers: Dark, Exposed, Leaves, Light, Period, Rate, Stomata, Transpiration.

When leaves of Vicia faba were exposed to light after being in the dark for 0.5 hr. the reappearance of normal transpiration on the upper side showed delay of 15-20 min. in relation to that of the under side. The reopening of the stomata under the effect of light occurred more slowly than their closing under the effect of darkness.--Copyright 1971, Biological Abstracts, Inc. W72-02820

COMPARATIVE STUDIES OF PLANT GROWTH AND DISTRIBUTION IN RELATION TO WATER LOGGING: II. AN EXPERIMENTAL STUDY OF THE RELATIONSHIP BETWEEN TRANSPIRATION AND THE UPTAKE OF IRON IN ERICA CINEREA L. AND E. TETRALIX L,

Nature Conservancy, Grange-over-Sands (England). Merlewood Research Station.

J Ecol. 59 (1): 167-178. Illus. 1971.

Identifiers: Anti, Comparative, Distribution, Erica-Cinerea-D, Erica-Tetralix-D, Growth, Iron, Oil, Plant, Relation, Relationship, Silicone, Trans-pirants, Transpiration, Uptake, Waterlogging.

Earlier studies had indicated that death of Erica cinerea plants in waterlogged conditions was preceded by a build-up of Fe in the tissues. Experi-ments with cut shoots indicated that the transpiraments with cut shoots indicated that the transpira-tion rate in E. cinerea was higher than in E. tetralix, and anti-transpirants, in the form of silicone oils, were fairly effective in reducing this transpiration rate. It was felt that there might be a link between the high rate of transpiration and the accumulation of iron in plants in water logged soils. Cut shoots were used in a preliminary attempt to elucidate this relationship, and results showed that, when the shoots were sprayed with anti-transpirant, they accumulated significantly less Fe from solutions containing it than when they were not sprayed. An experiment with intact plants showed that when E. cinerea was treated with anti-transpirant it could survive for much longer periods of time when waterlogged than it it were not treated. The treated plants also contained significantly less iron in their tissues than the untreated plants, although in E. tetralix the reverse trend was observed, and sprayed plants contained more iron than unsprayed ones. It was proposed that the effects on E. tetralix might be due to a physiological disturbance within the plant, caused by the anti-transpirant spray rather than a direct result of lowering the transpiration rate.—Copyright 1971, Biological Abstracts, Inc. W72-02901

RETARDED STOMATAL CLOSURE BY PHEN-YLMERCURIC ACETATE,

California Univ., Davis. Dept. of Water Science Engineering.
For primary bibliographic entry see Field 03B.
W72-02932

## 2E. Streamflow and Runoff

NONLINEAR RESPONSE OF A SMALL DRAINAGE BASIN MODEL,

Uttar Pradesh Agricultural Univ., Naini Tal (In-

dia), R. A. Rastogi, and B. A. Jones, Jr. Journal of Hydrology, Vol 14, No 1, p 29-42, October 1971. 7 fig, 5 tab, 18 ref.

Descriptors: \*Simulation analysis, \*Rainfall-runoff relationships, Small watersheds, Drainage patterns (Geologic), Channel morphology, Mathematical models, Rainfall intensity, Peak discharge, Unit hydrographs, Depth-area-duration analysis, Hydrograph analysis, Illinois Identifiers: \*Kinematic wave theory.

A surface flow model utilizing the kinematic wave theory was applied to a third-order stream system which represented conditions in Williamson and which represented conditions in Williamson and Johnson Counties, Illinois. The model drainage basin was considered as a distributed hydrologic system with the stream network, channel characteristics, and overland flow lengths as distributed hydrologic variables. Different order channel lengths, channel cross-sections, and channel slopes were treated as spatially distributed. The peak flow rates for a given rainfall-excess duration showed a nonlinear response with the rainfall-excess intensinonlinear response with the rainfall-excess intensities. The base or time duration of a direct run-off hydrograph increased with an increase in rainfall-excess intensity and duration. (Knapp-USGS) W72-02009

ASYMPTOTIC EXTREME-VALUE DISTRIBU-TIONS OF WAVE HEIGHTS IN THE OPEN OCEAN.

ental Data Service, Silver Spring, Md. H. C. S. Thom.

Journal of Marine Research Vol 29, No 1, p 19-27, January 15, 1971. 5 fig, 3 tab, 10 ref.

Descriptors: \*Waves (Water), \*Ocean waves, \*Probability, \*Statistics, Frequency analysis, Distribution patterns, Data collections, Data processing. Identifiers: Wave height (Water).

The Frechet extreme-value distribution was applied to extreme wave heights. Annual extreme significant wave-height data for 12 Ocean Station Vessels were fitted by the distribution. These distributions were adjusted to extreme wave-height distributions by applying a scale transformation to the significant wave-height distributions based on previous theoretical and empirical studies of wave-height tobservations. (Knapp-USGS) W72-02259

## Group 2E-Streamflow and Runoff

THE ELECTROMAGNETIC FIELD OF LONG AND INTERMEDIATE WATER WAVES, National Oceanic and Atmospheric Atmospheric

Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.

Journal of Marine Research, Vol 29, No 1, p 28-45, January 15, 1971. 4 fig, 20 ref.

Descriptors: \*Tsunamis, \*Electrical studies, \*Electromagnetic waves, Waves (Water), Frequency, Ocean waves, Geophysics, Oceanography. Identifiers: Electromagnetic fields (Water waves).

The electromagnetic field induced by long and intermediate water waves (tsunami) is dependent on the time variation and spatial variation of the water motion and on the earth's electrical conductivity structure. The water motion is approximated by a plane progressive wave on a nonrotating flat infinite ocean of uniform depth. The earth's conductivity is approximated by plane uniformly conductive layers that represent the ocean, the bottom sediments, and the highly conductive mantle. The analytical solution to the electromagnetic problem shows the important influence of frequency, wave number, and oceanic and mantle conductivity, all of which modify the field through both self induction and mutual induction. Amplitudes of the electromagnetic field are tabulated for a range of tsunami frequencies. (Knapp-USGS) W72-02260

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 13. SNAKE RIVER

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W72-02265

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 3. OHIO RIVER BASIN, VOLUME 3.

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W72-02266

THE NIAGARA RIVER PLUME, PART 2. THE MIXING OF THE NIAGARA RIVER PLUME IN LAKE ONTARIO.

Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch. For primary bibliographic entry see Field 02H. W72-02276

REGULATION OF STREAMFLOW (REGU-LIROVANIYE RECHNOGO STOKA), For primary bibliographic entry see Field 04A. W72-02319

IN-CHANNEL HYDRAULIC GEOMETRY OF STREAMS IN KANSAS,

Geological Survey, Lawrence, Kans. For primary bibliographic entry see Field 08B. W72-02322

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 2. SOUTH ATLANTIC SLOPE AND EASTERN GULF OF MEXICO BASINS, VOLUME 3.

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W72-02348

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 14. PACIFIC SLOPE BASINS IN OREGON AND LOWER COLUMBIA RIVER BASIN.

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W72-02349 AN ANALYSIS OF HYDROLOGIC TIME SE-RIES AND GENERATION MODELS OF SYNTHETIC FLOWS FOR SOME INDIANA WATERSHEDS

Purdue Univ., Lafayette, Ind. Water Resources Center.

For primary bibliographic entry see Field 02A. W72-02351

USE OF SYSTEMS ANALYSIS IN THE DEVELOPMENT OF WATER RESOURCES MANAGEMENT PLANS FOR NEW YORK STATE, ADDENDUM,
New York State Dept. of Environmental Conserva-

tion, Albany. Bureau of Water Resources Planning. For primary bibliographic entry see Field 06A. W72-02361

EXPERIMENTAL INVESTIGATION HYDRAULIC TRANSIENTS IN RIVER-RESERVOIR SYSTEMS - PHASE II,

Tennessee Univ., Knoxville. Dept. of Civil Engineering and Engineering Mechanics.
B. A. Tschantz, W. A. Miller, Remy L. de Jong, and

Y. C. Tseng.

Available from the National Technical Information Service as PB-205 180, \$3.00 in paper copy, \$0.95 in microfiche. Tennessee Water Resources Research Center, Knoxville, Research Report No 21, October 1971. 60 p, 19 fig, 2 tab, 24 ref. OWRR B-010-Tenn (1).

Descriptors: \*Hydraulic transients, Streamflow, Open channel flow, \*Unsteady flow, \*Computer programs, River systems, \*Mathematical models. Identifiers: \*Wave motion, \*Translatory waves, Streamflow control, \*River-reservoir systems.

A digital computer program for solving the basic equations of unsteady flows in rivers and reservoirs has been used since 1966 by TVA to solve a variety of open channel problems. Although impressive TVA success has been achieved in verifying field measurements under certain unsteady river-reservoir conditions using a digital computer to solve the one-dimensional mathematical model called 'SOCH,' little attention has been paid to experimental laboratory flume studies. A 62-foot-long l ft. by 1 ft. cross-sectional plexiglass flume was used for the laboratory study. Transient wave motions were created by time-varying discharge at the upstream end by means of an automatic sluice gate system for both reservoir and steady open channels conditions. Experimental velocity and stag data were obtained through the use of high-speed photography and hydrogen-bubble generation. A total of fourteen runs were made -- nine reservoir and five steady open channel runs. The TVA computer program output, which predicts temporal and spatial variations in water surface elevations and mean cross-sectional velocities, was compared to experimental water surface elevations and availatop, middle, and bottom centerline profile velocities at a selected observation station. The experimental results showed that laboratory models of unsteady flows created by long translatory waves can be simulated by the TVE one-dimensional mathematical model 'SOCH.' W72-02434

URBAN RUNOFF IN LAKE COUNTY. IL-LINOIS.

State of Illinois, Lake Michigan and Adjoining For primary bibliographic entry see Field 05B. W72-02597

PRESENT AND FUTUR HYDROMETEOROLOGICAL FUTURE USE DATA WATERSHED PROJECT PLANNING, Soil Conservation Service, Casper, Wyo.

For primary bibliographic entry see Field 04A. W72-02747

HYDROMETEOROLOGICAL NETWORKS IN WYOMING - THEIR DESIGN AND USE. For primary bibliographic entry see Field 02A.

GROWTH OF THE VOLGA DELTA EDGE DURING REGULATION OF STREAMFLOW AT VOLGOGRAD (PRIROST KRAYA DEL'TY VOLGOGRAD (PRIROST KRAYA DEL'TY VOLGI ZA PERIOD ZAREGULIROVANIYA STOKA U VOLGOGRADA), For primary bibliographic entry see Field 02J. W72-02776

CALCULATING WATER SUPPLY IN A CHANNEL NETWORK ON THE BASIS OF MORPHOLOGICAL STRUCTURE PATTERNS (RASCHET ZAPASA VODY V RECHNOY SETI NA OSNOVE MORFOLOGICHESKIKH ZAKONOMERNOSTEY YEYE STROYENIYA), Gidrometeorologicheskii Nauchno-Issledovatelskii Tsentr, Leningrad (USSR).

Yu. V. Gorbunov.

Meteorologiya i Gidrologiya, No 2, p 57-68,
February 1971. 2 fig, 2 tab, 11 ref.

Descriptors: \*Water storage, \*Water supply, Descriptors: "Water storage, "Water supply, \*Channel flow, \*Channel morphology, Streams, Streamflow, Inflow, Low flow, Floodwater, Discharge (Water), Cross-sections, Runoff forecasting. Identifiers: \*USSR, Oka River, Stream orders.

A new method for calculating the water available for storage in a channel network and in its in-dividual reaches was developed on the basis of the relationship of streamflow to the stream-order system for periods of low and high flow. Provided sufficient information is available on discharges, the accuracy of storage calculations, as illustrated by the Oka River, may be plus or minus 10%. During low flow the stream-order distribution of the water available for storage is described by a non-linear relationship in which channel storage decreases 1.5- to 2-fold with a decrease of the stream order by one order number. At the time of high water, as well as during low flow, water storage is always concentrated in the large stream orders. The water available for storage in the first 4-6 stream orders of large rivers of 13-14 stream orders does not warrant consideration, because it constitutes less than 5% of the total water available in the channel network. The method examined may be used to calculate water inflow to the channel network of the Oka River and to make a long-term forecast of its runoff. (Josefson-USGS) W72-02780

USE OF OPTIMIZATION METHODS FOR DETERMINING PARAMETERS OF FORMU-LAS TO CALCULATE MAXIMUM LAS TO CALCULATE MAXIMUM DISCHARGES OF RIVERS (PRIMENENIYE METODOV OPTIMIZATSII K OPREDELENIYU PARAMETROV FORMUL DLYA RASCHETA MAKSIMAL'NYKH RASKHODOV REK), Latvian Scientific Research Inst. of Hydraulic En-

gineering and Reclamation, Jelgava (USSR). A. A. Zivert.

Meteorologiya i Gidrologiya, No 2, p 69-74, February 1971. 1 fig, 8 ref.

Descriptors: \*Mathematical studies, \*Optimiza-tion, \*Discharge (Water), \*Runoff, \*Rivers, Rivers basins, Floodwater, Forests, Lakes, Gaging sta-

Identifiers: \*USSR, Latvia, Lithuania, Waterlogging, Coefficient of variation

Maximum discharges of rivers depend upon a number of meteorological and geological factors, which determine the accumulation of water on the surface of a basin, the infiltration of water into the ground, and the character of water flow on slopes and in river channels. To determine parameters of working formulas to calculate maximum river discharges, optimization methods were applied to a study of spring high-water and flood runoff of rivers

## Groundwater—Group 2F

in the Latvian and Lithuanian SSR. The optimiza-tion methods used provide for a more reliable study of the interrelationship of maximum runoff factors and are recommended for use in other areas of the USSR to refine the effect of various local factors (forest cover, waterlogging, lake surface area) on the maximum discharges of rivers. (Josefson-USGS) W72-02782

RECONNAISSANCE OF THE PERE MARQUETTE RIVER, A COLD WATER RIVER IN THE CENTRAL PART OF MICHIGAN'S SOUTHERN PENINSULA,

Geological Survey, Washington, D.C. G. E. Hendrickson, and C. J. Doonan. Geological Survey Hydrologic Investigations Atlas HA-384, 2 sheets, 1971. Text, 6 fig, 3 map, 6 tab,

Descriptors: \*Water resources development, \*Hydrologic data, \*Data collections, \*Rivers, \*Michigan, Hydrology, Streamflow, Flow rates, Water yield, Water quality, Chemical analysis, Water demand, Recreation, Water temperature.

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Sheet 1 of this two-page hydrologic atlas presents information on streamflow and water quality for the Pere Marquette River in Michigan. Sheet 2 describes the physical characteristics of the stream channel, bed, and banks, and shows how these characteristics relate to streamflow, water quality, and recreational use. Measured velocities in the Pere Marquette ranged from less than 1 foot per second in the pools to more than 5 feet per second at Rainbow Rapids. In a year of average discharge, the stage of the Pere Marquette at the gaging sta-tion at Scottville fluctuates only about 3 to 4 feet. Maximum summer water temperatures of the Pere Marquette at Scottville are about 22 deg C (72 deg Fo. Measured dissolved oxygen ranged from 7.2 to 10.4 mg/liter. This is a normal range for an unpolluted cold-water stream with moderate bottom vegetation. During the period October 1965 to May 1968, the water from the Pere Marquette at the gaging station at Scottville fluctuated in specific conductance between 195 and 360 micromhos. Two possible threats to the recreational values of the Pere Marquette are future contamination from increased waste disposal and pesticides, and degradation of the river banks by excessive cabin development. (Woodard-USGS) W72-02784

CHANGES IN THE DOWNSTREAM INSECT AND AMPHIPOD FAUNA CAUSED BY AN IM-POUNDMENT WITH A HYPOLIMNION DRAIN, Wisconsin Univ., Madison. Dept. of Entomology. For primary bibliographic entry see Field 02H. W72-02814

INFLUENCE OF KARST ON STREAMFLOW IN THE EUROPEAN USSR (VLIYANIYE KARSTA NA STOK REK YEVROPEYSKOY TERRITORII SSSR), V. A. Balkov.

Gidrometeoizdat, Leningrad, 1970. 216 p.

Descriptors: \*Streamflow, \*Runoff, Descriptors: "Streamflow, "Runoff, "Karst, "Geomorphology, "Topography, Orography, Slopes, River basins, Rivers, Hydrologic aspects, Floodwater, Low flow, Rainfall-runoff relation-ships, Runoff coefficient, Surface-groundwater relationships, Subsurface runoff, Hydrographs, Regulation, Variability, Seasonal. Identifiers: "European USSR, Urals, Crimea, Cau-

casus, Karst topography, Karstic rocks, Geotectonics, Regionalization, Mineralization, Variation

coefficient.

This monograph, which is the first Russian summary work on the hydrological role of karst, is devoted by Wolf of the influence of lowland and mountain karst on streamflow in various parts of the European USSR, including the Russian Plain, Urals, Crimea, and the northern slope of the Greater Cau-

casus. The influence of karst on average annual streamflow and its variability, seasonal regulation of streamflow, and on high and low flow was examined in the light of developing a classification of karstic rivers on the basis of their morphology and runoff. The book is intended for use by hydrologists engaged in a study of the water resources of rivers and by hydrogeologists interested in the interrela-tionship of subsurface and surface waters. (Josef-son-USGS) W72-02856

INTERRELATIONSHIP OF GROUNDWATERS AND SURFACE WATERS IN THE LITHUANIAN SSR (VOPROSY YZAIMOSVYAZI PODZEMNYKH I POVERKHNOSTNYKH VOD YUZHNOY PRIBALTIKI).
Institut Geologii. Vilnius (USSR).
For primary bibliographic entry see Field 02A.
W72-02860

CORRELOGRAM ANALYSIS REVISITED, Thomas J. Watson Research Center, Yorktown Heights, N. Y. For primary bibliographic entry see Field 04A. W72-02863

STATISTICAL PROPERTIES OF MUL-TIVARIATE PROCESSES. FRACTIONAL NOISE Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 04A. W72-02865

A STATISTICAL METHOD FOR FLOW PRE-DICTION, RIVER MURRAY EXAMPLE, Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Mathematical Statistics. For primary bibliographic entry see Field 04A. W72-02866

AN ANALYSIS OF THE LAWS OF STREAM ORDER FOR FIBONACCI DRAINAGE PAT-

South Carolina Univ., Columbia. Dept. of Geology. For primary bibliographic entry see Field 04A. W72-02868

NON-LINEAR RESONANCES BETWEEN KEL-VIN WAVES IN LAKE MICHIGAN, United States Lake Survey, Detroit, Mich For primary bibliographic entry see Field 02H. W72-02889

## 2F. Groundwater

BASE OF FRESH GROUND WATER (APPROXI-MATELY 3,000 MICROMHOS) IN THE SAN JOAQUIN VALLEY, CALIFONRIA, Geological Survey, Menlo Park, Calif. Water For primary bibliographic entry see Field 04B. W72-02258

WATER RESOURCES OF THE COAMO AREA. Geological Survey of Puerto Rico, San Juan. For primary bibliographic entry see Field 04B, W72-02272

SUMMARY OF WATER RESOURCES OF SALT

LAKE COUNTY, UTAH, Geological Survey, Salt Lake City, Utah. For primary bibliographic entry see Field 04B. W72-02273

NONTHERMAL SPRINGS OF UTAH. Geological Survey, Salt Lake City, Utah. J. C. Mundorff. Available from Utah Geol and Mineralog Survey, 103 Utah Geol Survey Bidg, SLC 84112, \$4.00. Utah Geological and Mineralogical Survey Water-Resources Bulletin 16, August 1971. 70 p, 15 fig, 2 plate, 2 tab, 24 ref.

Descriptors: \*Springs, \*Artesian wells, \*Hydrologic data, \*Cold springs, \*Utah, Data collections, Groundwater movement, Water yield, Water quality, Aquifer characteristics, Chemical analysis, Water supply, Water users, Water demand, Water resources development, Hydrogeology. Identifiers: \*Groundwater resources (Utah), \*Noethkemaldwinder\* \*Nonthermal springs.

Data are presented for about 4,500 nonthermal springs that discharge in the State of Utah. Most major springs having discharge of several cubic feet major springs having discharge of several cubic feet per second or more are in or near mountain ranges or plateaus where precipitation is much greater than in other parts of the State. The largest instantaneous discharge observed was 314 cfs at Mammoth Spring in southwestern Utah. Discharges exceeding 200 cfs were observed at Swan Creek Spring in extreme northern Utah, and discharges of 200 cfs were observed at Swan Creek Spring in extreme northern Utah, and discharges of Spring in extreme northern Utah, and discharges of 200 cfs were reported for Big Brush Creek Spring in northeastern Utah. Maximum discharges of other springs range from 25 to 90 cfs. Maximum discharges generally are during or within a few weeks after the main period of snowmelt, which is usually from late April to the middle of June. The largest springs generally discharge from or very near carbonate rocks in which solution channels and fractures are numerous or from areas of propous near carbonate rocks in which solution channels and fractures are numerous or from areas of porous or fractured volcanic rocks. Most nonthermal springs in Utah probably are variable springs—that is, their variability of discharge exceeds 100 percent. Most of the major springs discharge water that contains less than 500 ppm of dissolved solids, and most of the water is of the calcium bicarbonate them. What from springs is used for deposition type. Water from springs is used for domestic, municipal, irrigation, livestock, mining, and industrial purposes. (Woodard-USGS)
W72-02275

REGIONAL GROUND-WATER SYSTEMS IN THE NEVADA TEST SITE AREA, NYE, LIN-COLN, AND CLARK COUNTIES, NEVADA, Geological Survey, Carson City, Nev.

F. E. Rush. Nevada Division of Water Resources, Water Resources-Reconnaissance Series Report 54, 1971. 25 p, 1 fig, 1 plate, 3 tab, 14 ref.

\*Groundwater Descriptors: movement. Hydrogeology, \*Aquifer characteristics, "Hydrologic data, Nevada, Surveys, Groundwater recharge, Water types, Water yield, Geology, Discharge (Water), Precipitation (Atmospheric), Arid climates, Semiarid climates, Aquifers, Data collections, Topography. Identifiers: \*Groundwater flow systems (Nevada),

\*Groundwater resources, Groundwater hydrology.

Groundwater resources are described for 16 hydro graphic areas between Tonopah and Las Vegas, Nevada, centered on the Nevada Test Site of the U.S. Atomic Energy Commission. The area is arid to semiarid, having an average annual precipitation of about 5 inches on the valley floors to as much as 20 inches in the wetter mountains. Volcanic-rock aquifers in the eastern part of the study area locally transmit water downward to carbonate-rock aquifers. In the western part of the area, the vol-canic-rock aquifers transmit a regional flow of water, as do the carbonate-rock aquifers of the eastern part of the area. The Ash Meadows system is in the eastern two-thirds of the area, the Pahute Mesa system in the western third, and the Sarcobatus Flat system is west of the study area includ-ing Cactus Flat. The estimated average annual recharge and discharge for the Ash Meadows re-gional system are 33,000 and 17,000 acre-feet, respectively; for the Pahute Mesa regional system these estimates are 11,000 and 9,000 acre-feet; and for Sarcobatus Flat regional system, 3,500 acre-feet. (Woodard-USGS) W72-02280

## Group 2F-Groundwater

WATER RESOURCES OF PUERTO RICO, PHASE II: GROUND WATER APPRAISAL. Domenech (R.A.) and Associates, Hato Rey (Puerto Rico); and Black and Veatch, Kansas City, Mo. For primary bibliographic entry see Field 04B. W72-02291

HYDROLOGY OF THE PLEISTOCENE SEDI-MENTS IN THEWYOMING VALLEY, LU-ZERNE COUNTY, PENNSYLVANIA, Geological Survey, Harrisburg, Pa. For primary bibliographic entry see Field 04B. W72-02303

YIELDS AND SPECIFIC CAPACITIES OF BEDROCK WELLS IN KENTUCKY, Geological Survey, Louisville, Ky. For primary bibliographic entry see Field 04B. W72-02305

ICE LENSES IN THE EASTERN PART OF THE SELENNYAKH RANGE AND UYANDINA DEPRESSION, THEIR FORMATION CHARAC-TERISTICS AND IMPORTANCE FOR EVALUATING GROUNDWATER RESOURCES (NALEDI VOSTOCHNOY CHASTI SELEN-NYAKHSKOGO KHREBTA I UYANDIN SKOY VPADINY, OSOBENNOSTI IKH FOR-MIROVANIYA I OTSENKA PO NIM RESUR-SOV POSZEMNYKH VOD), Moscow State Univ. (USSR). Chair of Permafrost

Study. For primary bibliographic entry see Field 02C. W72-02316

AN EVALUATION OF GROUND-WATER CON-DITIONS IN THE VICINITY OF THE BEL BAY DEVELOPMENT, LUMMI INDIAN RESERVA-TION, WASHINGTON.

Geological Survey, Tacoma, Wash. For primary bibliographic entry see Field 04B. W72-02320

ATRIPLEX POLYCARPA: II. GERMINATION AND GROWTH IN WATER CULTURES CON-TAINING HIGH LEVELS OF BORON, California Univ., Riverside. Dept. of Agronomy. N. J. Chatterton, C. M. McKell, J. R. Goodin, and

F. T. Bingham.

Agron J. 61 (3): 451-453. Illus. 1969. Identifiers: Atriplex-Polycarpa-D, Boron, Cultures, Desert, Germination, Growth, High, Saltbush-D. A study of seed germination and growth of 3 popu-

A study of seed germination and growth of 3 populations of Atriplex polycarpa under greenhouse conditions using water cultures showed it to be very tolerant to high concentrations of B in the growth medium. Germination was not affected by B. Growth varied among populations but was generally not reduced by up to 40 ppm B in the culture solutions. High levels of B had no effect on nool/top ratio or percent water in the top growth.

Although growth was somewhat reduced in 80 ppm
B, no visible morphological changes occurred or
toxicity symptoms appeared.—Copyright 1971,
Biological Abstracts, Inc.

W22 07200.

FISHERY RESOURCES OF THE STATE AND SCOPE OF DEVELOPMENT OF FISHERIES IN MADHYA PRADESH: I,

G. P. Dubey.
Vikram J Vikram Univ. 11 (1-3): 35-39. 1967.
Identifiers: Development, Fish, \*Fisheries, Fishery,
Food, India, Madhya, Pradesh, Resources.

From the point of view of fishery resources Madhya Pradesh is very rich in riverine system as well as major and minor irrigation dams, tanks and ponds. A number of good food fish are available and cul-ivated at public and private sector levels. There are good resources for the collection of natural seed as well as their artificial production.--Copyright 1971, Biological Abstracts, Inc. W72-02715

HYDROMETEOROLOGICAL NETWORKS IN WYOMING - THEIR DESIGN AND USE. For primary bibliographic entry see Field 02A. W72-02748

COST OF DOMESTIC WELLS AND WATER TREATMENT IN ILLINOIS, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 06C. W72-02753

AQUIFERS CHANGING BETWEEN THE CON-FINED AND UNCONFINED STATE, Birmingham Univ. (England). Dept. of Civil En-

gineering.
K. R. Rushton, and L. A. Wedderburn.
Ground Water, Vol 9, No 5, p 30-39, SeptemberOctober 1971. 9 fig, 1 tab, 8 ref.

Descriptors: \*Analog models, \*Aquifers, \*Confined water, Water table, Equipment, Resistance networks, Transmissivity, Storage coefficient, Specific yield, Limestones, Aquifer characteristics, Drawdown, Groundwater movement, Artesian

Some aquifers change between the confined and the unconfined state due to the water table crossing the top of the aquifer. Such a change is of considerable significance because the storage coeffisiderable significance because the storage coeffi-cient for the unconfined aquifer can be up to 1000 times greater than that for the confined aquifer. The most promising method of studying this problem appears to be the resistance-capacitance network analog which solves the finite difference form of the differential equation. A device which will automatically model the change between the confined and the unconfined storage coefficients is confined and the unconfined storage coefficients is the Field Effect Transitor switch. A full description is given of the switching technique showing how the transistor switch is included in the resistance-capacitance network. (Knapp-USGS) W72-02754

SOME APPLICATIONS OF GEOPHYSICAL WELL LOGGING TO BASALT HYDROGEOLO-

GY, Washington State Univ., Pullman. Div. of Engineering Research.
For primary bibliographic entry see Field 07B.
W72-02756

HIGH-CAPACITY WELLS FOR CONJUNCTIVE

USE OF WATER, Geological Survey, Denver, Colo. For primary bibliographic entry see Field 04B. W72-02757

SOME REGULARITIES OF DISTRIBUTION OF MICRO- AND MACRO-COMPONENTS IN THE OIL-FIELD WATERS OF AZERBAIDZHAN, Akademiya Nauk Azerbaidzhanskoi SSR, Baku. Inst. of Inorganic and Physical Chemistry.
For primary bibliographic entry see Field 02K.
W72-02774

HYDROLOGY OF BASALT AQUIFERS IN THE HERMISTON-ORDNANCE AREA, UMATILLA AND MORROW COUNTIES, OREGON, Geological Survey, Washington, D.C. J. H. Robison.

Available from U.S. Geol Survey, Wash, DC, 20242 - \$1.25 per set. Geological Survey Hydrologic Investigations Atlas HA-387, 2 sheets, 1971. Text, 8 fig, 3 map, 2 tab, 14 ref.

Descriptors: \*Water resources development, \*Groundwater, \*Water wells, \*Withdrawal, \*Oregon, Groundwater recharge, Aquifer characteristics, Water yield, Water level fluctuations, Drawdown, Hydrogeology, Water users, Water demand, Hydrology, Artificial recharge, specific capacity, Water quality, Chemical analysis.

Identifiers: \*Groundwater resources, \*Ground-water hydrology, Umatilla County (Oreg), Morrow County (Oreg).

This two-sheet atlas describes the geologic and hydrologic conditions that are related to recent declines in groundwater levels in the Hermiston-Ordnance Area of Umatilia and Morrow Counties, Ordnance Area of Umatilla and Morrow Counties, Oregon. The deeper aquifers are cut off from areas of potential recharge by the geologic features that produce aquifer compartmentalization. The flat water-level gradients in these zones and the continual decline of water levels in wells penetrating them suggest that several of these aquifer systems receive no recharge (except leakage down uncased wells). Water pumped is largely or entirely ancient water now being removed from storage. Due to differences in specific yield, a 10-foot water-level decline in the basalt represents less water removed than does a 1-foot decline in the alluvium and 1-2 percent in unconfined basalt aquifers. The large decline in the basalt is presently more significant than is the smaller decline in the alluvium because it results in (1) increased pumping costs due to the it results in (1) increased pumping costs due to the alluvium lift required and (2) increased depths to alluvium intr required and (2) increased depths to which wells must be drilled or deepened. The basalt aquifers might be recharged artificially with surface water by injection. However, if surface water is to be used to resolve local water problems, direct use of the water might be more economical. (Woodard-USGS)

W72-02783

L ADAPTATIONS OF RESERVOIR SIMULATION HYDROLOGICAL PETROLEUM TECHNIQUES. General Electric Co., Santa Barbara, Calif. TEM-

PO. D. Kleinecke.

Available from the National Technical Information Service as PB-205 313, \$3.00 in paper copy, \$0.95 in microfiche. 71 TMP-55, October 1971, 14 p, 1 append, 22 ref. OWRR C-1875 (No. 3175) (4).

Descriptors: \*Computer models, \*Groundwater, Simulation analysis, \*Oil reservoirs, Aquifers, Model studies.

There is a close parallelism between groundwater simulation and petroleum reservoir simulation and the two fields have exchanged techniques frequently. The current state-of-the-art for petrolefrequently. The current state-of-the-art for petrole-um reservoir simulation is discussed from a hydrological point-of-view. It is suggested that petroleum reservoir methods are interesting to hydrologists but not clearly superior to alternatives developed by hydrologists. A selected bibliography on petroleum reservoir simulation is included. W72-02832

INTERRELATIONSHIP OF GROUNDWATERS INTERRELATIONSHIP OF GROUNDWATERS AND SURFACE WATERS IN THE LITHUANI-AN SSR (VOPROSY YZAIMOSVYAZI PODZEMNYKH I POVERKHNOSTNYKH VOD YUZHNOY PRIBALTIKI).
Institut Geologii. Vilnius (USSR).
For primary bibliographic entry see Field 02A.
W72-02860

GENERAL ANALYSIS OF LONGITUDINAL DISPERSION IN NONUNIFORM FLOW, Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W72-02867

MATHEMATICAL MODEL FOR BEACH GROUNDWATER FLUCTUATIONS, Louisiana State Univ., Baton Rouge. Dept. of

Louisiana State Univ., Baton Rouge. Dept. of Chemical Engineering. T. F. Dominick, B. Wilkins, Jr., and H. Roberts. Water Resources Research, Vol 7, No 6, p 1626-1635, December 1971. 12 fig., 14 ref. NR 388 002. ONR Contract N00014-69-A-0211-0003.

Descriptors: "Water level fluctuations, "Water ta-ble, "Beaches, "Tidal effects, Tides, Waves (Water), Water chemistry, Groundwater move-ment, Aquifer characteristics, Diagenesis, Saline water-freshwater interfaces, Geochemistry. Identifiers: Grand Canyon Island, Beach aquifers.

Water levels were measured across a tropical car-bonate beach profile over three tidal cycles to provide basic data for the development of a predictive mathematical model of the fluctuation in the level of a beach water table. The model is based on partial differential equations governing transient, one-dimensional movement of groundwater through porous media. A finite difference algorithm for the digital computer was developed to solve the equa-tions. Beach homogeneity and nonlinear boundary conditions imposed by tidal fluctuations were as-sumed. Themathematical model simulates this system within the limits of accuracy of field mea-surements. A method for in situ determination of the permeability-porosity ratio is proposed and demonstrated. The mathematical model of the beach water table can be used to develop an accurate method of calculating inflow and outflow at the beach-ocean interface. (Knapp-USGS) W72-02871

ESTIMATING TRUNCATION ERROR IN IMAGE WELL THEORY, Arizona Univ., Tucson. Dept. of Hydrology and

Water Resources For primary bibliographic entry see Field 04B. W72-02875

OPTIMUM EXPLOITATION OF GROUND-WATER RESERVES WITH SALTWATER IN-

Resources for the Future, Inc., Washington, D.C. For primary bibliographic entry see Field 02L. W72-02876

HIGH HEAD PERMEABILITY OF SAND WITH

DISPERSED CLAY PARTICLES,
Mississippi State Univ., State College. Dept. of
Civil Engineering.
For primary bibliographic entry see Field 02G.
W72-02877

## 2G. Water in Soils

PREDICTION OF WATER MOVEMENT THROUGH SOILS-A FIRST STEP IN WASTE TRANSPORT ANALYSIS, Batelle Memorial Inst. Richland, Wash. Pacific

Northwest Lab.

For primary bibliographic entry see Field 05B. W72-02415

THEORETICAL RELATIONSHIPS IN CAPIL-ARY SYSTEMS BETWEEN CAPILLARY CON-DUCTIVITY, PORE SIZE DISTRIBUTION, TEN-SION, AND WATER CONTENT (IN SWEDISH), Institutionen for Markvetenskap, Uppsala (Sweden).

Sigvard Andersson Grundforbattring. 22 (4): 143-154. Illus. 1969. En-

glish summary. Identifiers: Capillary, Conductivity, Distribution, Moisture, Pore, Relationships, Size, Soil, Systems, Tension, Theoretical.

If some simple analytical relationships between soil water content w percentage and tension ht are postulated, interesting analytical relationships between the capillary conductivity k and pore diameter d, tension ht and water content w can be found. The relationship between water content and tension can be regarded as ideal laws which give hints for graphical analyses of the constructed curves, the moisture characteristics.—Copyright 1971, Biological Abstracts, Inc. W72-02511

SOME OBSERVATIONS ON COASTAL SOILS, Land Resources Div., Surbiton (England). J. Makin

East Afr Agr Forest J. 36 (1): 124-130. 1970. Identifiers: Acidification, Alkalification, Chemical, Coastal, Formation, Mineralogical, Slope, Soils,

The soils developed on sedimentary formations ranging from grit to shale, and include red and yellow lateritic soils, sandy regosols and poorfy drained tropical clays. Rocks of contrasting textural grades gave rise to soils with distinctive chemical, textural and mineralogical properties. Particularly acid and infertile conditions were found beneath the forest. The differential lateral alwaisting of fine particles may have a significant. found beneath the forest. The differential lateral eluviation of fine particles may have a significant role to play. Slope acidification is a normal development on well-drained and permeable parent materials in regions of high rainfall. An unusual case of slope alkalification is described. An outline is presented of the unique ecology of soils affected by saline hot springs.—Copyright 1971, Biological Abstracts, Inc. W72-02512

SPRINKLER INTENSITY AND SOIL TILTH, Utah State Univ., Dept. of Agribulture. Jack Keller

Trans Amer Soc Agr Eng. 13 (1): 118-125. Illus. 1970

Identifiers: Bulk, Density, Intensity, Irrigation, Moisture, Rate, Soil, Sprinkler, Tension, Tilth.

Irrigation application rate and duration have a definite effect on the tilth of certain medium and fine-textured soils. Soil tilth can be destroyed by high application rates especially when coupled with long duration and/or poor soil drainage. The total amount of surface settling of the 2 soils used was a function of the initial bulk density of the sample function of the initial bulk density of the sample and the application rate. A correlation between total surface settling and the minimum soil moisture tension during irrigation was also ob-served. The amount of settling for a given sample and initial density was inversely proportional to the minimum tension. Modified Mohr-Coulomb dia-grams were made for the sitt loam soils. The linear nature of these plots is predicted by a proposed theory.—Copyright 1971, Biological Abstracts, Inc. W72-02515

INFLUENCE OF SOIL PH ON SURFACE CHARGE AND WATER TRANSMISSION, Department of Agriculture, Lethbridge (Alberta).

Research Station

Research Station.
T. G. Sommerfeldt, and J. C. Van Schaik.
Can J Soil Sci. 51 (2): 277-282. Illus. 1971. Identifiers: Alkaline, Bentonite, Charge, Electrophoretic, Exchangeable, Loam, Mobility, pH, Reclamation, Sodic, Sodium, Soil, Surface, Trans-

The effects of pH were determined on the exchangeable Na and electrophoretic mobility of Na-saturated bentonite from Greybull, Wyoming, and Na-saturated Lethbridge loam and on the water transmission of the Lethbridge loam. The data obtained were related to problems of reclaiming an alkaline-sodic soil. The exchangeable Na of the bentonite and the loam increased about 50% from pH 6.0 to 8.0 but the rate of change with pH. from pH 6.0 to 8.0, but the rate of change with pH was not the same for both. The electrophoretic mo-bility of the loam increased 284% from pH 6.0 to 8.0, while that of the bentonite increased 53%. The water transmission of the loam at pH 6.5 and 7.0 was 7 times and twice, respectively, that at pH 8.0. Lowering the pH of an alkaline-sodic soil may be an effective means of enhancing its reclamation.-Copyright 1971, Biological Abstracts, Inc.
W72-02556

POLYSACCHARIDES IN SOILS,

Yutaka Kamoshita, Seiji Takeshima, and Kanetsu

Bull Fac Agr Tamagawa Univ. 10: 51-58. 1970. In Japanese and English summaries.

Identifiers: Arabinase, Poly, Saccharides, Soils, Xviose.

The amount of polysaccharides and the polysaccharide C:total C ratio are greater in brown forest soils (vegetation soil types) than in wet soil types. Cultivation seemed to increase hydrolyzable polysaccharies in brown forest soils. In brown forest soils, xylose, arabinose ribose, dextrose, and galactose, were found; in wet soil types, mannose, arabinose, and rhamnose, and ribose.—Copyright 1971, Biological Abstracts, Inc.

SOIL MOISTURE RECHARGE AND DEPLE-TION IN DRY AND FAIRLY MOIST FOREST TYPES OF THE STEPPE ZONE OF THE UKRANIAN SSR, (IN RUSSIAN),

Lesovod Agrolesomelior Respub Mezhvedom Temat Nauch Sb. 15. 36-44. 1968. Identifiers: Ash-D, Depletion, Dry, Fairly, Forest, Maple-D, Moist, Moisture, Oak-D, Pine-G, Recharge, Soil, Steppe, Types, Ukrainian-SSR,

Pure 40-50-yr-old pine stands on 'bor' (infertile) and 'subor' (fairly infertile) sites, and oak-groves, 48-yr-old oak stands with admixture of ash, Norway maple and field maple were studied. The density of all the stands was 0.6-0.7. The soil water regime types were determined. For the dry oak groves (D1) and fairly moist groves (D2) the impermeable type was common. This was seen on dry bor' (A1), on fairly moist 'bor' (A2) and on dry 'bor' (A1), on fairly moist 'bor' (A2) and on dry 'subor' (B1) sites. In the fairly moist 'subor' (B2), the soil water regime was related to the type of periodical wetting in the spring. The presence of the following clearly-expressed periods of soil moisture (SM) variation was established: fall-winter-spring recharge in the root zone (April-May) and spring-summer-fall depletion of SM (Aug-Oct). SM storage in fairly moist forest types are often lower, particularly in A2 and D2 than in the dry ones. In the 'bor,' greater SM storage is observed in the dry type, in comparison with the fairly moist type. In the 'subor microns,' the correlation of SM storage between the SM regime types was normal. Different types of soil water regime were observed: ferent types of soil water regime were observed: B1, impermeable; in B2, periodically washed through. The values of SM recharge and depletion in the fairly moist types were higher than in the dry ones. Greater SM depletion in fairly moist types was due to more intense transpiration of the stands. The quantitative differences between the water regime types should be established according to SM recharge and depletion and not according to SM storage.—Copyright 1971, Biological Abstracts, W72-02566

MEASURE OF WATER ADSORPTION ON SOILS AND CLAYS (IN SPANISH), Murcia Univ. (Spain). Dept. of Agricultural

Chemistry.
A. Lax, O. Carpena, and Perez J. M. Moreno.
An Edafol Agrobiol. 29 (7/8): 601-609. 1970. En-

glish summary. Identifiers: Adsorption, Clays, Measure, \*Soils.

In ionic exchange equilibria on soils, the necessity of using inner solution values is discussed. A procedure to find values of micellar water is described determining water adsorbed by the clay fraction, and its relationship to total water adsorbed by the soil.--Copyright 1971, Biological Abstracts, In W72-02622

EFFECT OF LEACHING SALINE-ALKALI SOILS WITH AND WITHOUT GYPSUM ON THE SOLUBLE SALTS BORON AND EXCHANGEABLE CALCIUM AND SODIUM OF THE SOILS.

Punjab Agricultural Univ., Ludhiana (India). N. S. Sahota, and D. R. Bhumbla.

### Group 2G-Water in Soils

Indian J Agr Sci. 40 (9): 763-771. Illus. 1970. Identifiers: Alkali, Alternate, \*Boron, \*Calcium, Drying, Exchangeable, Gypsum, Leaching, Ponding, Reclamation, Saline, \*Salts, Sodium, Soils,

In the top layer alternate ponding and drying was more effective than continuous ponding in leaching the salts, but in the bottom layers the reverse was true. To reduce the salt by about 70%, 60 cm of water was required for the soil depth of 0.30 cm and 120 cm of water was required for the soil depth of 0.50 cm. of 0.58 cm. Application of even 120 cm of water did not reduce more than 65% of the salt from the soil depth of 0.83 cm. The exchangeable Ca increased with an increase in the amount of water, whereas the exchangeable Na decreased cor-respondingly. The amount of B was very high in the original soils. For the same quantity of water applied, the reduction of B was much lower than the reduction of ohter salts. Application of 120 cm of water also did not remove boron from the surface soil to safe limits. The reduction of B by the application of 60, 90 and 120 cm of water was about 44, cation of 60, 90 and 120 cm of water was about 44, 55 and 58%, respectively, in the top 30-cm soil layer. Application of gypsum increased the efficiency of salt removal, but the steepest decrease in the salt content/unit volume of water occurred when gypsum was applied at 25% of its requirement combined with 60 cm of water. However, application of gypsum with lower levels of leaching was not as effective as with higher levels of leaching in increasing the exchangeable Ca.-Copyright in increasing the exchangeable Ca.--Copyright 1971, Biological Abstracts, Inc. W72-02625

AN IMPROVED WELDING JIG FOR PELTIER THERMOCOUPLE PSYCHROMETERS.

Pacific Northwest Forest and Range Experiment Station, Wenatchee, Wash. For primary bibliographic entry see Field 07B. W72-02702

# THE INFLUENCE OF EXCHANGEABLE CATIONS ON CERTAIN PHYSICAL PROPERTIES

OF A SALINE-ALKALI,
Agricultural Research Inst., Glen (South Africa).
A. J. Van Der Merwe, and R. Du T. Burger. Agrochemophysica. 1 (2): 63-66. Illus. 1969. (Afr. and Fr. summ.).

Identifiers: Africa, Alkali, Cations, Exchange, Exchangeable, Irrigation, Physical, Reclamation, Saline, Saturation, Soil, South.

The influence of exchange saturation with Ca, Mg and Na, singly or in various combinations, on the physical condition of a clayey saline-alkali soil from the Riet River Irrigation Scheme was investigated. Permeability and modulus of rupture were taken as indices to the physical condition of the soil with respect to water movement and tilth conditions, respectively. The single effects of Ca and Mg saturation upon these properties were almost identically favorable, whereas the Na-saturated soil exhibited an extremely poor physical condition. The combinations of Ca-Na and Mg-Na, however, affected these properties differently. At comparable mono-to divalent cation ratios the Mg-Na saturated soil was in a materially poorer condition than the Ca-Na saturated soil. This phenomenon may be an important factor in utilization of soils under irriga-tion.--Copyright 1971, Biological Abstracts, Inc. W72-02703

## EFFECT OF MOISTURE VARIATION ON SULFATE CONCENTRATION IN A BLACK SOLONETZ SOIL,

Department of Agriculture, Lacombe (Alberta). Research Station.

Commun Soil Sci Plant Anal. 1 (1): 7-12. Illus.

Identifiers: Black, Cation, Concentration, Gypsum, Moisture, Ratio, Soil, Solonetz, Sulfate.

In the sub-surface horizons a decrease in soil moisture up to about 35% resulted in a gradual in-

crease of sulfate concentration. However, with further decrease in moisture the sulfate concentration increased abruptly. Variation of sulfate concentration appears to alter significantly certain ca-tion ratios in the equilibrium solutions.—Copyright 1971, Biological Abstracts, Inc. W72-02704

THEORY OF WATER MOVEMENT IN SOILS:
I. ONE-DIMENSIONAL ABSORPTION,
Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
Jean-Yves Parlange.
Soil Sci. 11 (2): 134-137. Illus. 1971.
Identifiers: Absorption, Dimensional, Equation,
Horizontal, Movement, \*Soils, Theory, Water.

An approximate but analytical expression is developed for the solution of the equation for horizontal absorption of water in 1 dimension. The solution is very simple and very accurate for actual soils.—Copyright 1971, Biological Abstracts, Inc. W72-02728

## AGROCLIMATIC EVALUATION OF THE PRODUCTIVITY OF SPRING WHEAT ON THE BASIS OF SOIL-MOISTURE CONSUMPTION (AGROKLIMATICHESKAYA OTSENKA PRODUKTIVNOSTI YAROVOY PSHENITSY PO RASKHODAM VLAGOZAPASOV),

L. S. Kel'chevskaya, and N. I. Kobrina. Meteorologiya i Gidrologiya, No 2, p 86-93, February 1971. 3 fig, 2 tab, 12 ref.

Descriptors: \*Evaluation, \*Productivity, \*Crop production, \*Soil moisture, \*Consumptive use, Water utilization, Wheat, Plant growth, Seasonal, Precipitation (Atmospheric), Soils, Chernozems, Forest soils, Maps. Identifiers: \*USSR, Middle Volga Area, Volga

A method for quantitative evaluation of the productivity of spring wheat, based on the relation-ship of yield to soil-moisture consumption, was examined for various soil groups in the administrative regions of the Middle Volga Area in east-central European USSR. Soil moisture consumption during the growing period of spring wheat was calculated for each administrative region on the basis of maps showing the soil moisture consumption in the spring and at the end of the growing period, and from the average precipitation occurring in the period between sowing and crop maturity. Soil moisture consumption values for the area during the growing period were characterized by considerable fluctuation, varying between 260 and 150 mm. In the fertile Chernozem and Dark-Gray Forest soils of the western and northern regions moisture consumption was 250 mm or more. In the regions of Light-Gray Forest soils and podzolized, leached, and ordinary Chernozems soil moisture consumption was 250-225 mm, while in soils of the southern Chernozems it was 225-200 mm. It may be concluded from the relations obtained that a 10mm increase in moisture consumption leads to an average yield increase throughout the area of 0.6 cntr/ha depending upon soil fertility, with the increase ranging from 0.1-0.3 cntr/ha for the Gray-Forest soils to 0.8-0.9 cntr/ha for the fertile leached and podzolized Chernozems. (Josefson-USGS) W72-02779

#### WATERSHED PHYSICS: MODEL OF THE SOIL MOISTURE CHARACTERISTIC,

Agricultural Research Service, Beltsville, Md. A. S. Rogowski. Water Resources Research, Vol 7, No 6, p 1575-1582, December 1971. 5 fig, 2 tab, 20 ref.

Descriptors: \*Soil water movement, \*Infiltration, Soil moisture, Hydraulic conductivity, Estimating, Soil physics. Identifiers: Watershed physics.

Reasonable estimates of the soil moisture characreasonable estimates of the soil moisture characteristic can be obtained when a reliable curve is not available. Moisture content and pressure at air entry and at 15 bars constitute the required input parameters. The parameters are easily determined or can be readily obtained from published data. Applicability of the model is tested on graded sand and eight soils. (Knapp-USGS) W72-02869

# A FUNCTIONAL ITERATION TECHNIQUE FOR SOLVING THE RICHARDS EQUATION APPLIED TO TWO-DIMENSIONAL INFILTRA-TION PROBLEMS, New Mexico Inst. of Mining and Technology,

Socorro. Dept. of Geoscience W. F. Brutsaert.

Water Resources Research, Vol 7, No 6, p 1583-1596, December 1971. 6 fig, 3 tab, 17 ref, append.

Descriptors: \*Mathematical studies, \*Infiltration, Descriptors: "Manematical studies, "Inititation, "Groundwater movement, "Mathematical models, "Computer programs, Simulation analysis, Numerical analysis, Soil water movement, Unsaturated flow, Hydraulic conductivity.

In a solution of nonlinear parabolic partial dif-ferential equations, such as the Richards equation, classical implicit schemes often oscillate and fail to converge. A fully implicit scheme was developed along with a functional iteration method for solving the system of nonlinear difference equations. Newton's iteration technique is mathematically the best of all functional iteration methods because of its quadratic convergence. The Richards equation, Newton-linearized with respect to relative permea-bility and saturation as functions of capillary pressure, is particularly aided by this new approach for problems in which saturations vary rapidly with time (infiltration fronts, cone of depression near a well bore, and so forth). Although the computing time is almost twice as long for a time step with Newton's iteration scheme, the smaller time trun-cation than that of classical implicit schemes and the stability in cases in which classical schemes are unstable permit the use of much larger steps. To demonstrate the method, heterogeneous (layered) soil systems are used to simulate sharp infiltration fronts caused by ponding at the soil surface. (Knapp-USGS) W72-02870

## HIGH HEAD PERMEABILITY OF SAND WITH DISPERSED CLAY PARTICLES, Mississippi State Univ., State College. Dept. of

Wississiph State Chief, State Conege. Dept. of Civil Engineering. K. H. Denson, and P. K. Wu. Water Resources Research, Vol 7, No 6, p 1661-1662, December 1971. 3 fig, 2 ref.

Descriptors: \*Permeability, \*Sands, \*Expansive clays, \*Groundwater movement, Montmorillonite, Permeameters, Seepage, Hydraulic gradient, Dar-

Permeability coefficients of sand-clay mixtures were obtained for hydraulic gradients that ranged from 5.6 to 408. The sand had a mean diameter of 0.36 mm with a standard deviation of 0.20 mm. The expansive clay constituent contained approximately 2000. mately 30% montmorillonite. Clay percentages varied from 1/2 to 2-1/2%. The addition of 2-1/2% clay at a constant hydraulic gradient of 408 reduced the coefficient of permeability by 56.8%. For the 2-1/2% clay mixture, the coefficient of For the 2-1/2% clay mixture, the coefficient of permeability decreased by 16.6% as the hydraulic gradient increased from 5.6 to 408. The permeability coefficient for pure Columbus sand decreased by 12% as the hydraulic gradient changed from 5.6 to 408. (Knapp-USGS) W72-02877

## THE PEDOAMELIORATIVE EFFICIENCY OF SOME DRAINING SYSTEMS IN TARA BIRSEI, Institutul de Cercetari Pedol. (Rumania).

N. Stanga. Probl Agr. 21 (12): 39-49. Illus. 1969. Identifiers: Ameliorative, Draining, Pedo, Romania, Systems, Tara-Birsei.

Under the pedohydrologic and climatic conditions prevailing in Tara Birsei, open drain channels at a spacing of 135-250 m apart and 0.75-1.50 m dependid not produce a sufficient level for the phreatic and not produce a sufficient level for the phreatic waters, as their hydrostatic level generally averaged for the entire vegetation period less than 50 cm in each of the surveyed locations. Soil moisture and aeration conditions remained high, but did not conform with crop requirements.—Copyright 1971, Biological Abstracts, Inc. W72-02941

## A STUDY OF ASSOCIATED HYDROMORPHIC AND SODIC SOILS ON REDISTRIBUTED KAR-ROO SEDIMENTS.

Rhodesia Dept. of Research and Specialist Ser-

vices, Salisbury.
W. D. Purves, and W. B. Blyth.
Rhodesian J Agric Res. 7 (2): 99-109. Illus. 1969. Identifiers: Clay, Distributed, Hydromorphic, Karroo, Re, Rhodesia, Sediments, Sodic, Soils, Table,

Two water-tables were found, a fluctuating high permanent water-table and a seasonal perched water-table. The former is caused by the formation of an impermeable and extremely sodic area on the lower part of the middle catena. This area developed under the influence of a fluctuating water-table of low salt content but relatively high in Na. Clay is being translocated in the dispersed state by both water-tables from the middle catena to the sodic area. Clay from the upper portion of the middle catena has an exchangeable Na percentage of greater than 5, but is in a dispersed state and is also being translocated. The upper catena has suffered some loss of clay in the past, but does not appear to be losing any clay at the present time.—Copyright 1971, Biological Abstracts, Inc. W72-02943

# STUDIES ON THE CORRELATION BETWEEN CALCIUM-BOUND PHOSPHATE AND FREE CALCIUM CARBONATE IN WATERLOGGED

SOILS, Central Inland Fisheries Research Inst., Calcutta

Central Inland Fisheries Research Inst., Calcutta (India). Soil Chemistry Unit. S. M. Banerjea, and S. B. Ghosh. J Indian Soc Soil Sci. 18 (3): 259-263. Illus. 1970. Identifiers: Bound, Calcium, Carbonate, Free, Phosphate, Soils, Waterlogged.

In the soils showing buffer action, relative proportion of Ca-bound phosphate showed a direct cor-relation with free CaCo3.--Copyright 1971, Biological Abstracts, Inc. W72-02945

EFFECT OF WATERLOGGING ON REDOX POTENTIAL, AVAILABLE P AND PH IN SOME INDIAN ACID SOILS, Calcutta Univ. (India). Dept. of Agriculture. S. N. Chakravarti, and A. K. Kar. J Indian Soil Sci. 18 (3): 249-257. 1970. Identifiers: Acid, Available, Indian, pH, Phosphorus, Potential, Redox, Soils, Waterlogging.

Measurements of redox potential, available P, pH and Fe plus 2/Fe plus 3 ratio of 3 acid soils under waterlogged condition are reported on a time scale, the soils being previously treated with organic matter, Fe-P, Al-P and Fe-P-Al-P mixture. The redox potential in all cases underwent a sharp fall for a period of 3 wk followed by a gradual decrease to an almost constant value at the end of 3 mo. The sets receiving Fe-P and organic matter showed the lowest potentials. A gradual increase in available P and total Fe as well as Fe plus 3/Fe plus 3 ratio was observed with a decrease in redox potential in all the soils with the period of submer-gence. The trend of pH change was similar in all the treatments, a drop in pH in the 1st 2 wk followed by an increase to a near neutral and more or less constant value. All these effects were pronounced in

\*organic matter and Fe-P treatments.--Copyright 1971, Biological Abstracts, Inc. W72-02946

# INTERPRETATION OF ELECTRICAL-R-ESISTANCE SOIL MOISTURE DATA FOR A FREEZE-THAW ENVIRONMENT,

Department of Energy, Mines and Resources, Ot-Department of catergy, mains and resources, tawa (Ontario).

R. L. Harlan, J. A. Banner, and R. Allan Freeze.

Can J Soil Sci. 51 (2): 239-259. Illus. 1971. Identifiers: Canada, Electrical, Environment, Freeze, Interpretation, Moisture, Resistance, Soil,

The value of electrical-resistance measurements from soil moisture blocks in a freeze-thaw environment can be enhanced by laboratory calibration in the subzero temperature range to provide a mea-sure of unfrozen water contents. In the temperature range of incipient freezing and thawing (-3 to 0C) electrical resistance as measured with Colman fiberglas resistance blocks is independent of temperature. At temperatures less than -3C, electrical resistance is dependent upon both the nature of the porous medium and temperature, but is indepen-dent of the total water content of the soil-water system. Results from the laboratory investigations are extended to the interpretation of field measurements of electrical resistance for a soil profile at Calgary, Alberta, Canada.—Copyright 1971, Biological Abstracts, Inc. W72-02947

## 2H. Lakes

# A COMPILATION OF THE LAKES IN OREGON, WITH BIBLIOGRAPHY, Oregon State Univ., Corvallis. Dept. of Fisheries

and Wildlife

D. W. Larson, and J. R. Donaldson.

Oregon State University Water Resources Research Institute Research Report WRRI-8, Au-gust 1971. 125 p, 1 fig, 2 tab, 182 ref. OWRR A-003-ORE (6).

Descriptors: \*Lakes, \*Bibliographies, \*Hydrologic data, \*Data collections, \*Oregon, Sites, Geomorphology.

A compilation of 1,939 named lakes in Oregon is resented. Each lake, depending on its location, is listed alphabetically under one of nine physiographic divisions. Included is a bibliography containing 182 references pertaining to the lakes of Oregon. This literature represents a large part of what has been produced about the lakes of the state. (Woodard-USGS) W72-02256

## BEACH AND NEARSHORE DYNAMICS IN EASTERN LAKE MICHIGAN, Western Michigan Univ., Kalamazoo.

R. A. Davis, Jr., and W. T. Fox.

Available from National Technical Information Service, Springfield, Va., 22151 as AD-726 226, \$3.00 in paper copy, \$0.95 in microfiche. Techni-cal Report No 4, June 1971. 145 p, 83 fig, 14 ref, 2 append. ONR No 328-092, ONR N00014-69-C-0151.

Descriptors: \*Shores, \*Littoral drift, \*Sediment transport, \*Geomorphology, \*Lake Michigan, Surveys, Erosion, Hydrologic data, Data collections, Beaches, Currents (Water), Sedimentation, Topography, Waves (Water), Weather data, Model studies, Computer programs.

Surveys of beach and nearshore environments of two areas in southeastern Lake Michigan show changes in shore-line morphology. Eighteen varia-bles were measured at 2 hour intervals during a 30 day time series study. Morphologic responses and sedimentary processes were related to these varia-bles. Construction of a model of sedimentation in the nearshore environment was made from daily maps and time-distance diagrams. This provided a four-dimensional dynamic model which is a response model to the measured environmental variables. (Woodard-USGS) W72-02268

# EVALUATION OF EFFECT OF IMPOUND-MENT ON WATER QUALITY IN CHENEY RESERVOIR,

Colorado State Univ., Fort Collins. For primary bibliographic entry see Field 05C. W72-02274

# THE NIAGARA RIVER PLUME, PART 2 - THE MIXING OF THE NIAGARA RIVER PLUME IN LAKE ONTARIO,

LARE ONTAKIO,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
H. S. Weiler, and C. R. Murthy.
Canada Department of Energy, Mines and
Resources Inland Waters Branch Technical Bulletin No 38, 1971. 21 p, 15 fig, 2 ref.

Descriptors: \*Water circulation, \*Movement, \*Diffusion, \*Lake Ontario, \*Inflow, River flow, Tracking techniques, Tracers, Dye releases, Mixing, Currents (Water), Winds, Lake breezes, Dispersion, Aerial photography. Identifiers: \*Niagara River, Plume characteristics.

A diffusion study of the plume off the mouth of Niagara River in Lake Ontario showed the mixing of the river's plume with the main body of the lake in two stages: There was strong river mixing near the river's mouth; and beyond this area, there was harmost unifore from the properties of the properties of the property of the properties buoyant surface spreading of the warmer river water over the colder lake water. The fast river current developed the plume much more rapidly than in a typical lake with slow currents. Close to the source, the dye plume was narrow and always unidirectional. However, away from the source, the plume was well spread out and the direction was clearly dependent upon the prevailing wind direction. One striking aspect of all the dye plumes was the erratic lateral meandering bearing no rela-tion to typical lake conditions. A mosaic of the dye plumes prepared from the time sequence airphotos of the same series is shown. (Woodard-USGS) W72-02276

## CIRCULATION AND WATER MOVEMENT IN LAKE ERIE,

Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch. P. F. Hamblin.

Canada Department of Energy, Mines and Resources Inland Waters Branch Scientific Series No 7, 1971. 49 p, 25 fig, 36 ref, append.

Descriptors: \*Water circulation, \*Path of pollutants, \*Lake Erie, \*Diffusion, \*Movement, Tracking techniques, Tracers, Dye releases, Hydrologic data, Currents (Water), Aquatic drift, Drift bottles, Data collections, Lakes, Mixing. Identifiers: \*Plume study.

Available knowledge of the circulation, water movements, and diffusive processes occurring in Lake Erie are summarized from published works and studies conducted at the Canada Center For Inland Waters. In addition, the residence time, theory of lake circulation and diffusion are discussed. An atlas of monthly averaged currents is provided in an appendix. Knowledge of water cir-culation and diffusion processes provide a means of gaining insight into certain physical processes and mechanisms occurring within the lake. From a pragmatic viewpoint, an important aspect is to be able to predict the response of the water quality of a lake to changing levels of inputs. Descriptions of the directly and indirectly determined circulations, and the measurements of diffusion are divided into three separate sections for each of the western, central and eastern basins of Lake Erie. The boundaries of these regions and geographical names are provided. (Woodard-USGS)

## Group 2H-Lakes

W72-02277

SELENIUM IN LAKE SEDIMENTS -- ANALYTICAL PROCEDURE AND PRELIMINARY RESULTS,
Wisconsin Univ., Madison. Water Chemistry Pro-

gram. J. H. Wiersma, and G. F. Lee. Environmental Science and Technology, Vol 5, No 12, p 1203-1206, December 1971. 4 tab, 8 ref.

Descriptors: \*Trace elements, \*Sediments, \*Lakes, \*Analytical techniques, Chemical analysis, Fluorometry, Sampling, Water chemistry, Ecosystems. Identifiers: \*Selenium

A fluorometric analytical procedure for the determination of selenium in lake sediments is presented. The sample is digested in nitric and perchloric acids. The selenium is reduced and coprecipitated by arsenic and hypophosphorous acid. The precipitate is dissolved in HNO3, allowed to react with DAN reagent, and extracted with cyclohexane with the fluorescence being measured on the extract. Selenium content of sediments from 11 Wisconsin lakes and one South Dakota reservoir (Woodard-USGS)
W72-02300

EFFECTS OF FORCED AERATION ON A HYPEREUTROPHIC LAKE (EFFEKT PRINU-FIROVANNOGO OZERA),
Akademiya Nauk SSSR, Moscow. Institut

For primary bibliographic entry see Field 05C. W72-02312 Geografii.

HYDROLOGY OF HORSESHOE LAKE, AR-

KANSAS, Geological Survey, Little Rock, Ark. For primary bibliographic entry see Field 04A. W72-02321

EVAPORATION FROM LAKE AND LAND PANS AT THE U.S. ARMY ENGINEER WATER-WAYS EXPERIMENT STATION, JANUARY 1941 THROUGH DECEMBER 1945, Army Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 02D. W72-02326

SEDIMENT ANALYSIS OF THE BEACHES OF LAKE VANDA, WRIGHT VALLEY, Georgia Univ., Athens, Dept. of Geology. For primary bibliographic entry see Field 02J. W72-02331

DIURNAL GEOCHEMISTRY OF CANOPUS POND, WRIGHT VALLEY, 1969-1970, Ohio State Univ., Columbus. Inst. of Polar Studies. T Trickhill, and L. M. Jones.

Antarctic Journal of the United States, Vol 6, No 5, p 201-202, September-October 1971. 2 fig. NSF Grant GA-14427 and GA-14573.

Descriptors: \*Water quality, \*Chemical analysis, \*Ponds, \*Algae, \*Antarctic, Data collections, Sampling, Seasonal, Summer.

Canopus Pond, which sustains a large algal population, is a small (60 by 70 m), undrained pond located between Lake Vanda and the valley wall in located between Lake Vanda and the valley wall in Antarctica. It is approximately 0.4 km south of Lake Vanda and 65 m above the present level of Lake Vanda. During the winter the pond is frozen completely to the bottom; during the 1969-1970 austral summer, it was ice-free except for an ice remnant that accounted for approximately 35 percent surface area. On occasion, when the sun was below the mountain range to the south during the

early hours of the day, a thin film of ice would form over its surface. For 3 days - January 20-22, 1970 - Canopus Pond was sampled at 2- to 3-hour intervals. The concentrations of chloride ranged from 120 to 200 mg/liter. The variation of ion concentrations in Canopus Pond over such brief periods has tentatively been attributed to the algal population. (Woodard-USGS) W72-02332

IDENTIFICATION AND CHARACTERIZATION OF OIL POLLUTANTS IN WATER VIA SIMUL-TANEOUS GAS CHROMATOGRAPHY EM-PLOYING FLAME IONIZATION AND FLAME PHOTOMETRIC DETECTORS FOR SULFUR AND PHOSPHORUS, Environmental Protection Agency, Chicago, Ill.,

Water Quality Office.
For primary bibliographic entry see Field 05A.
W72-02334

SCARBOUROUGH BLUFFS--A RECESSIONAL STUDY.

Toronto Univ. (Ontario). Dept. of Civil Engineer-

For primary bibliographic entry see Field 02J. W72-02335

NATURAL AND ARTIFICIAL SEDIMENT TRACER EXPERIMENTS IN LAKE ONTARIO, Canada Centre for Inland Waters. Department of Energy, Mines and Resources, Burlington (Ontario). For primary bibliographic entry see Field 02J. W72-02336

MODELS FOR NEARSHORE SAND TRANS-Raytheon Co., New London, Conn. Marine Research Lab. For primary bibliographic entry see Field 02J. W72-02337

FE-MN OXIDATE CRUSTS IN ONEIDA LAKE, NEW YORK,

Syracuse Univ., N. Y. Dept. of Geology. For primary bibliographic entry see Field 02K. W72-02338

PROFILE OF A STORM-WIND, WAVES AND BROSION ON THE SOUTHEASTERN SHORE OF LAKE MICHIGAN, Williams Coll., Williamstown, Mass. Dept. of

Geology. W. T. Fox, and R. A. Davis, Jr.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 233-241, 1970. 6 fig, 2 tab, 5 ref. Project 388-092. ONR Contract N00014-69-C-0151.

Descriptors: \*Storms, \*Beach erosion, \*Lake Michigan sand bars, Data collections, Fourier anal-ysis, Sediment transport, Littoral drift, Weather, Winds, Waves (Water), Surf, Profiles, Great Lakes.

A large low pressure system that passed through Lake Michigan during late July 1969, provided op-portunity for detailed analysis of storm effects on beach and nearshore processes. During the passage of this storm, observations on 17 environmental parameters were recorded at 2 hr intervals. These data were subjected to Fourier analysis and plotted in a time series by computer. There was a definite relationship between barometric pressure, breaker height, breaker angle and longshore current velocity, the significant factors in beach erosion. As the storm passed, the beach and adjacent cliff were extensively eroded. A nearshore sand bar was derived from the beach area during the storm. During succeeding days, this bar began a shoreward migration and was eventually incorporated with the beach. (See also W72-01094) (Knapp-USGS) W72-02340

A GEOMORPHIC MAP OF LAKE MICHIGAN

SHORELINE, United States Lake Survey, Detroit, Mich. E. B. Hands.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International As-sociation for Great Lakes Research, p 250-265, 1970. 15 fig, 7 ref.

Descriptors: \*Geomorphology, \*Shores, \*Lake Michigan, Great Lakes, Beach erosion, Sediment transport, Littoral drift, Erosion, Topography, Aerial photography, Photogrammetry

The shoretypes of Lake Michigan are: uncon-solidated bluffs, formed where moraines intersect the shoreline; dunes, restricted primarily to the eastern shore; deltas, found in Green Bay; rock exposures; marshes; swamps; and low dry plains. The nearshore classification is primarily descriptive of longshore bar patterns and turbid water areas, but a cellular pattern characterizes two localities. Updrift beach accumulations and diverted stream mouths show a southerly littoral drift along both the east and west coasts of Lake Michigan's southern basin with frequent reversals in direction along northern shores. (See also W72-01094) (K-napp-USGS) W72-02341

LAKE ONTARIO NEARSHORE SEDIMENTS,

WHITBY TO WELLINGTON, ONTARIO,
Department of Energy, Mines and Resources,
Burlington (Ontario). Canada Centre for Inland

For primary bibliographic entry see Field 02J. W72-02342

F.A.S.T. - FAST ANALYSIS OF SEDIMENT TEXTURE.

Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland Waters.

For primary bibliographic entry see Field 02J. W72-02343

UNDERWATER PHOTOGRAPHY IN THE GREAT LAKES - A REPORT, Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland

Water P. G. Sly

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International As-sociation for Great Lakes Research, p 282-296, 1970. 14 fig, 2 tab, 8 ref.

Descriptors: \*Photography, \*Underwater, \*Instrumentation, Great Lakes, Sampling, Cameras, Films, Lighting, Surveys. Identifiers: \*Underwater photography.

Underwater photographic techniques were tested Underwater photographic techniques were tested for bottom sediment photography in the Great Lakes. Three photographic systems were used: an EG and G 205-206-35 mm system, a Hydro-Products PC790/P F101 - 70 mm system, and a Hydro Products PC770/PF102 - 70 mm diverheld system. Plus-X pan was the best black and white film tested. Tests were also made using Kodak Ek-tachrome-K, high-speed Ektachrome, Kodachrome II and Kodachrome II-A. Results were generally of if and Kodachrome II-A. Results were generally of better quality then those derived from comparable black and white studies, and Ektachrome-X was considered the most suitable of the films tested. The photographic systems use low angle oblique lighting to illuminate a field approximately 1 m square. The cameras are mounted vertically, about 1.5-2 m above the sediment interface, and provide well illuminated pictures with constant scale factor. (See also W72-01094) (Knapp-USGS) W72-02344

Lakes-Group 2H

A VIBRO CORER AND PORTABLE TRIPOD--WINCH ASSEMBLY FOR THROUGH ICE SAMPLING, Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland Waters.

For primary bibliographic entry see Field 02J. W72-02345

NEAR-SHORE SEDIMENTS IN SOUTHERN LAKE ONTARIO, THEIR DISPERSAL PATTERNS AND ECONOMIC POTENTIAL,

Rochester Univ., N.Y.
For primary bibliographic entry see Field 02J.
W72-02346

DATA REQUIREMENTS FOR THE OBJECTIVE ANALYSIS OF GEOSTROPHIC WINDS OVER LAKE ONTARIO,

Northern Illinois Univ., DeKalb. Dept. of Geography.
A. L. Cole, and R. C. Hilfiker.

A.L. Cole, and R. C. Hiffiker.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 326-336, 1970. 11 fig, 3 tab, 4 ref. Nat. Air Pollut. Contr. Admin. Grant AP01201-01.

Descriptors: \*Synoptic analysis, \*Winds, \*Lake Ontario, \*Data collections, Meteorological data, Great lakes, Distribution patterns, Meteorology, Networks, Stations, Weather

Identifiers: \*Geostrophic winds.

Geostrophic winds can be calculated from an objectively determined pressure field covering the Lake Ontario region. Existing pressure data are too pressure data are to sparse to produce any but a very gross pattern of pressure. The requirement for additional pressure data was studied by supplementing the data from all pressure measuring stations with locations arbitrarily chosen to fill in the areas of sparse data. For a pressure pattern representative of a frontal passage, few additional stations were necessary and passage, few additional stations were necessary and most of the lake stations could be eliminated without drastically altering the pressure pattern. For a lake anticyclone pattern, typical of those that produce lake breezes, the lake stations were vital to the reproduction of the original pattern and a large amount of supplementary land station data could not reproduce the original pattern without the lake data. (See also W72-01094) (Knapp-USGS) W72-02347

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 2. SOUTH ATLANTIC SLOPE AND EASTERN GULF OF MEXICO BASINS, VOLUME 3.

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W72-02348

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 14. PACIFIC SLOPE BASINS IN OREGON AND LOWER COLUMBIA RIVER BASIN.

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W72-02349

THE DISTRIBUTION AND CONTROL OF MACROPHYTE BIOMASS IN LAKE WINGRA, Wisconsin Univ., Madison. Water Resources For primary bibliographic entry see Field 04A. W72-02350

THE COASTAL BENTHIC FAUNA OF LAKE ST. LOUIS NEAR MONTREAL (QUEBEC): I. SOME GENERAL DATA, Dep. Sci., Biol., Univ., Montreal, Ont., Can. For primary bibliographic entry see Field 05C. W72-02438

BIOENERGETIC STRUCTURE OF THE ECOSYSTEM IN THE PELAGIC ZONE OF LAKE BAIKAL, K. K. Votintsev

R. R. Votintsev.

Zool Zh 50 (2): 165-172. Illus. 1971 (Engl summ). Identifiers: Baikal, Comephorus-Baicalensis, Comephorus-Dybowskii, Cyclotella, Ecosystem, Energetic, Epischura-Baicalensis, Gymnodinium, Lake, Macrohectopus-Branickii, Melosira, Pelagic, Structure, Synedra, USSR, Zone.

The general quantitative scheme of the energy flux in the ecosystem of the Baikal Lake pelagic zone is given. The main role in the energy flux is played by the genera Meloaira, Cyclotella, Synedra, Cym nodinium from phytoplankton, a planktonic crustacean-phytoplankton, a planktonic crustacean-phytoplankton baicalensis, Macrohectopus branickii from predatory zooplankton and Balkal olifishes (Comephorus baicalensis, calensis, C. dybowskii).--Copyright 1971, Biological Abstracts, Inc. W72-02455

FIRST REPORT OF THE LAKE MICHIGAN, AND ADJOINING LAND STUDY COMMISSION

OF THE STATE OF ILLINOIS.
State of Illinois, Lake Michigan and Adjoining Land Study Commission. For primary bibliographic entry see Field 05G. W72-02459

A CONTRIBUTION TO THE KNOWLEDGE OF ZOOPLANKTON IN LAKE HANCZA, Zakl. Zool. Syst. Dosw., Pol. Adad. Nauk, Krakow,

Waclaw Kochan.

Acta Hydrobiol. 13 (1): 117-131. Illus. Map. 1971 (Engl summ). Identifiers: Associations, Cladocerans, Copepods,

Hancza, Lake, Plankton, Poland, Rotifers.

Materials in this study were collected in Lake Hancza from Aug. 9 to 16, 1966. The lake is situ-ated in the Suwalki Lake District (Poland). Three systematic groups of animals were examined: rotifers, cladocerans, and copepods. The study showed that the zooplankton belongs to the Daphnio-Diaptometum graciloides from the Daphnio-Calanidion lacustre association, characteristic of oligotrophic lakes.—Copyright 1971, Biological Abstracts, Inc.

ARTIFICIAL LAKES AND LAND SUBDIVISIONS,

For primary bibliographic entry see Field 06E. W72-02489

METHOD FOR MEASURING MINERALIZA-TION IN LAKE SEDIMENTS, Oregon State Univ., Corvallis. Dept. of Microbiolo-

gy and Oceanography.
Michael J. Harrison, Richard T. Wright, and Richard Y. Morita.

Appl Microbiol. 21 (4): 698-702. 1971. Identifiers: Bacteria, Lake, Measuring, Method, Mineralization, Sediments.

A method is described for measuring the mineralization of an organic solute (14C-glucose) by the heterotrophic indigenous bacteria in lake diments. Since there is no suitable procedure for the determination of in situ microbial activities in sediments, the procedure described is probably the best devised so far and may serve as a base for a more definitive procedure.—Copyright 1971, Biological Abstracts, Inc.

A SPECIES LIST OF FRESHWATER ALGAE FROM THE TAIPING LAKES, PERAK, MALAYSIA,

Fish Culture Research Training Inst., Malacca (Malaysia). Gerald A. Prowse, and M. Ratnasabapathy.

Gard Bull (Singapore). 25 (2): 179-187. Maps. 1970. Identifiers: Acid, Algae, Fresh, Lakes, List, Malay-sia, Perak, Species, Taiping.

A list of 95 spp. of freshwater algae is the result of collections in late 1957 when the area was fairly well stabilized. The waters of the Taiping Lakes sampled were clearly aicd, the pH ranging from 4 to 6.—Copyright 1971, Biological Abstracts, Inc. W72-02504

AN ECOLOGICAL STUDY OF THE MACROPHYTIC VEGETATION OF THE DOODHADHARI LAKE, RAIPUR, M. P., INDIA: I. DISTRIBUTION AND SEASONAL CHANGE

IN AQUATIC PLANTX, Government D.S.V. Sanskrit Coll., Raipur (India). K. Sankaran Unni.

Hydrobiologia. 37 (1): 139-155. Illus. 1971. Identifiers: Aquatic, Distribution, Doodhadhari, Ecological, India, Lake, Macrophytic, Madhya, Plants, Pradesh, Raipur, Seasonal, Succession, Vegetation.

Permanent belt transects were run from 8 stations every month for a year to assess the seasonal change in vegetational composition. Each transect was taken from the shore to the maximum depth. A contour survey was made and the total area during different seasons were determined. The fluctuation of water level was marked almost every fornight for of water ever was marked amous every foring in to a year. The percentage frequency and percentage cover of different species exhibited significant changes during different seasons. Except a few sub-merged aquatic plant species which are perennial all other species appear and disappear as the seasons progress. The perennial species which are not much affected by the seasonal change are extensively eaten by cattle. The pattern of succession was outlined.--Copyright 1971, Biological Abstracts, Inc. W72-02573

BIOLOGY AND PRODUCTIVITY OF MASS SPECIES OF CLADOCERA FROM THE KIEV RESERVOIR (IN RUSSIAN),

Akademiya Nauk URSR, Hidrobiologii. G. A. Zhdanova, and Y. Y. Tseeb.

Gidrobiol Zh. 6 (1): 43-49. Illus. 1970. English

summary. Identifiers: Biology, Ceriodaphnia-Pulchella, Cladocera, Daphnia-Cucullata, Daphnia-Hyalina, Diaphanosoma-Brachyurum, Kiev, Mass, Produc-tivity, Reservoir, Species, USSR, Vegetation.

The biology and production of mass species of planktonic Cladocera in the Kiev reservoir in the 2nd and 3rd years of existence (a period of in-creased trophy) was studied. Daphnia hyalina was found all year round, reaching the highest numb at 19-23 degrees. Monthly production was 0.445-6.2 g/m cu. The P/B (Production/Biomass)-coefficient varied within the limits 2.2-4.5, for the season it was equal to 17; D. cucullata was widely distributed in summer intensively propagating at 22-23 degrees. Production for 4 months varied at an average within the limits 0.246-4.207 g/m cu. The P/Bcoefficient was equal to 10.8, the average one P/Bcoefficient was equal to 10.8, the average one for the season-16; Diaphanosoma brachyurum was most abundant in July and August. The production for 4 summer months was 3.7-5.2 g/m cu. The P/Bcoefficient was 13, for the season-20; Ceriodaphnia pulchella was typical for the littoral plankton and developed in mass quantity during the 1st years of the reservoir existence. The most intensive partheno-genetic reproduction was observed during the 1st decade of July. Average monthly production was 0.5-0.6 g/m cu. The P/B-coefficient for the vegetation season was equal to 19.—Copyright 1971, Biological Abstracts, Inc. W72-02587

COMPARATIVE BACTERIOLOGICAL IN-VESTIGATION OF THREE SHALLOW HUN-

## Group 2H-Lakes

GARIAN LAKES WITH DIFFERENT TROPHIC

LEVELS, Magyar Tudomanyos Akademia, Tihany. Biological Research Inst. For primary bibliographic entry see Field 05C. W72-02588

THE QUANTITATIVE PROPORTIONS OF ROTIFERA PLANKTON IN LAKE BALATON,

IN 1967, Magyar Tudomanyos Akademia, Tihany. Biologi-cal Research Inst.

Nora Zankai, and Jeno E. Ponyi.

Ann Inst Biol (Tihany) Hung Acad Sci. 37: 291-308. Illus. 1970. Russian summary.

Identifiers: Balaton, Hungary, Keratella, Cochlearis, Keratella-Cochlearis-Tecta, Keratella-Quadrata, Lake, Plankton, Polyarthra-Vulgaris, Ponpholyx-Sulcata, Populations, Proportions, Quantitative, Rotifera.

With regard to the quantity of the total Rotifera significant difference occurred between Keszthely-Bay and the open water areas of the lake. The average values per section during the whole period of investigation in Kreszthely-Bay yielded 64 spp./l while for the other sections ('K' -- 'E') this value fluctuated between 125 and 171. The 24 spp. determined during the investigations, including varieties and forms include 5 spp. (Keratella cochlearis, K. c. tecta, K. quadrata, Polyarthra vulgaris and Pompholyx sulcata) regarded as the main Rotifera in Lake Balaton. From among these spe-cies the population of K. quadrata and P. sulcata increases once in the whole area of the lake. K. cochlearis and K. c. tecta show 2 maxima in the middle part of the lake, while towards the 2 ends of Lake Balaton they show only 1 maximum. Polyarthra shows clear population increase twice only in Keszthely-Bay, while in the other parts of the lake it shows 3 maxima. Maximum development generally occurs in May, Aug. and Oct. The quantitative change of the Rotifera plankton is inversely proportional with Seechi (transparency) i.e. it is directly proportional with the concentrai.e. it is directly proportional with the concentra-tion of the formed foodstuff. The double population increase of total Rotifera and the proliferation of species indicating eutrophic processes indicate that Lake Balaton may be classified among the moderately eutrophic waters.--Copyright 1971, Biological Abstracts, Inc. W72-02589

SHORT PERIODIC CHANGES IN THE MICROBIAL PLANKTON QUANTITY OF LAKE BALATON,

Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.

Ann Inst Biol (Tihany) Hung Acad Sci. 37: 199-207. Russian summary.

Hungary, Lake, Microbial, Periodic, Plankton, Quantity, Seasonal, Short, Stock.

The short periodic changes of the saprophytic and total microbial plankton varied according to seasons: in winter, under the ice the short periodic change was not significant; in spring, with a temperature rise a significant short periodic change perature rise a significant snort periodic change was observed even without a decrease rise a significant short periodic change was observed even without a decrease in Secchi transparency in Keszthely-Bay the number of saprophytes increased by several magnitudes. Without a Secchi decrease there was no significant short periodic change; in autumn, the sudden decrease in transparency brought about pronounced short periodic changes. Consequently, the short periodic changes are due to temperature and to the wind disturbing the sediment. In winter, under the ice was a stabile stratification and in the bottom layer the quantity of the total microbial plankton (2 times 10 to the 6th power/ml) surpassed the values measured in spring, summer and autumn. The high number of bacteria bears a close connection with the winter formation of the micro-algal stock exceeding 19

times 10 to the 6th power/l. All these conditions made possible the development of a significant stock of zooplankton. The mass proliferation of micro-algae in the reeds was lacking and the quantity of the total microbial plankton was likewise smaller, consequently, the number of zooplankton was also law. The object recognitions the property of the control of the was also low. The short seasonal investigations supwas also low. The short segments appear the previously observed spring maximum and summer-late summer minimum seasonal dynamics.—Copyright 1971, Biological Abstracts, Inc. W72-02590

LAKE MICHIGAN WATER QUALITY TRENDS. State of Illinois, Lake Michigan and Adjoining Land Study Commission. For primary bibliographic entry see Field 05G. W72-02594

ON THE VARIATION OF THE CARBON CON-TENT IN SEDIMENT PROFILES FROM THE LAKE LOHJANJARVI, SOUTHERN FINLAND (IN FINNISH),

Esa Kukkoner

Geologi. (9/10): 147-149. Illus. Map. 1970 English

summary.
Identifiers: Bacterial, \*Carbon, Climate, Finland,
Lake, Leaching, Lohjanjarvi, Nutrient, Profiles,
\*Sediment, Southern.

The highest C values were found in sediments formed during the cool and moist climatic stages following the climatic optimum. At the time considerable amounts of humus were transported into the lake. Leaching increased the nutrient concentrations in the lakewater and bacterial activity. As a result the sediments formed are low in C.--Copy-right 1971, Biological Abstracts, Inc. W72-02619

FISH OF THE VYGONOVSKOE LAKE AND

FISHERY, Belorussian State Univ., Minsk (USSR). F. N. Voronin, and V. V. Krylov. Vestn Zool. 5 (1): 74-79. Illus. 1971. (Engl.

Gibelio-, Fish, Fishery, Lake, Rhodeus-SericeusAmarus, USSR, Vygonovskoe.

Vygonovskoe is the biggest lake in the Byelorussian Polesie. Its area is 2596 ha. and 16spp. of fish inhabit it. The fish species belong to the typical Polesie. Its area is 2596 ha. and 16spp. of fish inhabit it. The fish species belong to the typical forms, except for sub-species Carassius auratus gibelio (Bloch.) and Rhodeus sericeus amarus (Bloch.). In 1953-1954 the lake was supplied with Cauratus gibelio (Bloch.). It propagated fast and became a dominating species. In 1964 the catches of this fish reached 108 kg/ha or 76% of the total catch. In the following years there were fewer. of this fish reached 10s kg/ha of 70% of the total catch. In the following years there were fewer catches. There is also a small amount of Abramis brama (L.) in the lake.—Copyright 1971, Biological Abstracts, Inc. W72-02659

FISHINGPRESSURE, GROWTH AND RECRUITMENT IN A SMALL HIGH LAKE, Institute of Freshwater Research, Drottningholm

T. Lindstrom, A. Fagerstrom, and K. J. Gustafson. Rep Inst Freshwater Res Drottningholm. 50. 100-132. Illus. 1970.

Identifiers: Fishing, Growth, High, Lake, Mountain, Pressure, Recruitment, Salmo-Trutta, Salvelinus-Alpinus, Small, Temperature.

Increasing annual removal of trout (Salmo trutta) and char (Salvelinus alpinus) from 0.1 km to the 2nd power lake decreased the average size and the number per standard gill net. The average growth number per standard gill net. The average growth rate of trout increased (studies of char were not made). Abundance of year classes of trout was positively correlated with May-June temperatures and with size of spawning population. Mark and recapture estimates indicated 3 to 4 catchable char contents and the state of the state o and trout per 10 m to the 2nd power.--Copyright 1971, Biological Abstracts, Inc. W72-02669

FISH OF LAKE PILBURG (AUSTRIA), Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.

yslaw Kolder Acta Hydrobiol, 12 (4): 329-355, Illus, 1970 (Engl

Identifiers: Austria, Fish, Fishery, Lake, Leuciscus-Cephalus, Perca-Fluviatilis, Pilburg, Rutilus-Ruti-tus, Salmo-Irideus, Salmo-Trutta-Fario, Salmo-Trutta-Lacustris, Scardinius-Erythrophthalmus.

In 1966, limnological and ichthyobiological research was carried out on Lake Pilburg (915 m. above sea level), Austria, within the framework of ecological investigations by the Obergurgl Alpine Research Station of Innsbruck University. By fishing with net and rod, the presence of 7 spp. of fish was established in the lake: roach (Rutilus rutilus L.), chub (Leuciscus cephalus L.), and red eye (Scardinius erythrophthalmus L.) of the carp family; rainbow trout (Salmo irideus Gibb.) and brown trout (Salmo trutta m. fario L.) and Salmo trutta m. Lacustris L. of the Salmonidae family; and finally, perch (Perca fluviatilis L.). The age of the fish, their growth, weight variability, and coefficient of condition were studied. On the basis of the results obtained, the future of the fishery economy of the lake and its exploitation were evaluated.—Copyright 1971, Biological Abstracts, Inc. W72-02674

BIOSTIMULATION AND ALGAL GROWTH KINETICS OF WASTEWATER,
Utah State Univ., Logan. Dept. of Civil Engineer-

For primary bibliographic entry see Field 05B. W72-02690

ADENOSINE TRIPHOSPHATE IN LAKE SEDI-MENTS: I. DETERMINATION, Wisconsin Univ., Madison. Dept. of Soils. For primary bibliographic entry see Field 02J. W72-02695

ADENOSINE TRIPHOSPHATE IN LAKE SEDI-MENTS: II. ORIGIN AND SIGNIFICANCE, Wisconsin Univ., Madison. Dept. of Soils. For primary bibliographic entry see Field 02J. W72-02696

PROLONGED SALMONELLA CONTAMINA-TION OF A RECREATIONAL LAKE BY RU-NOFF WATERS, Wisconsin Univ., Madison. School of Medicine. For primary bibliographic entry see Field 05B. W72-02705

THE EFFECT OF LAKE REGULATION ON POPULATIONS OF CESTODE PARASITES OF SWEDISH WHITEFISH COREGONUS, Lund Univ. (Sweden). Dept. of Animal Ecology. For primary bibliographic entry see Field 04A W72-02707

FISHERY RESOURCES OF THE STATE AND SCOPE OF DEVELOPMENT OF FISHERIES IN MADHYA PRADESH: I,

For primary bibliographic entry see Field 02F. W72-02715

REPRODUCTION AND EARLY LIFE HISTORY OF THE WALLEYE IN THE LAKE WINNEBAGO REGION,

Wisconsin State Dept. of Natural Resources, Madison.

G. R. Priegel. Wis Dep Natur Resour Tech Bull. 45. 1-105. Illus.

Maps. 1970. Identifiers: Early, History, Lake, Life, Management, Reproduction, Spawning, Stizostedion-Vitreum-Vitreum, USA, \*Walleye, Winnebago, Wiscon-

The early life history of the walleye (Stizostedion vitreum vitreum) in Lake Winnebago and connecting waters was studied from 1959 to 1967 to determine factors affecting spawning success, egg development and fry survival. Spawning success was influenced by the number, size and condition was influenced by the number, size and condition of available spawning, areas, egg development by fluctuating water levels and substrate types, and fry survival by water levels on the marshes and by river velocity. Because spawning areas were large and numerous and of high quality, factors limiting egg development or fry survival did not affect the establishment of year classes of walleyes on Lake Winnebago. Highest management priority is the state ownership of existing spawning marshes.— Copyright 1971, Biological Abstracts, Inc. W72-02741

## LAKE LADOGA (LADOZHSKOYE OZERO).

Gidrometeoizdat, Leningrad, 1968. 160 p.

Descriptors: \*Limnology, \*Lakes, \*Lake morphology, \*Lake morphometry, Lake basins, Lake shores, Climatology, Water balance, Heat balance, Radiation, Waves (Water), Seiches, Currents (Water), Water level fluctuations, Aquatic plants, Aquatic animals, Bottom sediments, Water plants, Aquatic animais, bottom sediments, was quality, History, Projects.
Identifiers: \*USSR, \*Lake Ladoga, Leningrad Oblast, Karelia, Lake Onega, Neva River.

This monograph, prepared on the basis of extensive investigations by the Laboratory of Limnology of Leningrad State University, is devoted to a study of the developmental history and the meteorological, physical, chemical, and biological characteristics of Lake Ladoga, the largest body of water in Europe. Various aspects of the nature of the lake are examined: morphology, morphometry, water and heat balance, radiation regime, surface waves, seiches, currents, water level fluctuations, bottom sediments, flora and fauna, etc. Particular attention is given to the water-quality characteristics of the lake and to the role of biochemical processes in the regimes of dissolved gases and biogenous substances. The monograph concludes with a brief historical account of the economic exploitation of the lake and shore area dating from its first colonization by Slavs in the Ninth Century A.D. to present-day plans for development. The text material is designed for use by hydrologists, limnologists, geographers and all who are concerned with the scientific study of lake origins and various lake processes. (Josefson-USGS)
W72-02773

## LIMNOLOGICAL STUDY OF THE IRIZAR LAKE, DECEPTION ISLAND, SOUTH SHET-LAND, (IN SPANISH),

Instituto Antartico Argentino, Buenos Aires.

Norberto L. Bienati.

Contrib Inst Antart Argent. 111. 1-36. Illus. Maps. 1967 (English summary). Identifiers: Deception, Irizar, Island, Lake, \*Lim-

nological, Salinity, Shetland, South, Temperature.

Limnological studies were made of the Irizar Lake on Deception Island (South Shetland Islands), which is also of meromictic origin, but unlike the remaining known lakes of Antarctica it is the 1st one in which the characteristic property of a cold monomictic lake was found, namely only 1 period of free circulation. On the bottom of this lake sulphurous water of high salinity and high temperature was found. The bathymetry, the thermal and chemical stratification, and biological contents of probable origin of the monimolimnium. The observations cover period from Feb to Oct 1963.—Copyright 1971, Biological Abstracts, Inc.

# MATERIALS FOR ECOLOGICAL STUDY ON LAKE SUWA: PRELIMINARY REPORT, Shinshu Univ., Matsumoto Faculty of Science

Tokio Okino, Hiroshi Yamagishi, Haruo Fukuhara, Hidetake Hayashi, and Yoshito Watanabe.

Misc Rep Res Inst Nat Resour. 71. 40-41. Maps. Identifiers: Ecological, Japan, \*Lake, Materials,

A large number of biological and limnological stu-A tage number to follow a factor and immological studies on Lake Suwa were made to make clear the relation between primary production and the decomposition of organic products. The surveys were carried out mainly at a fixed station (5.3 m deep) in the off-shore of Osaka.—Copyright 1971, Biological Abstracts. Biological Abstracts, Inc. W72-02794

# A FARIO 'TROUT FURUNCULOSIS' SYN-DROME DUE TO XANTHOMONAS PISCICOLA

For primary bibliographic entry see Field 05C. W72-02802

## SHORT PAPER ON THE ENVIRONMENT AND THE PHYTOPLANKTON OF TWO TROUT PONDS AT MIRWART (UPPER BELGIUM), (IN

FRENCH),

Rrussels Univ. (Belgium). Laboratoire de Brussels Univ. (Belgium). Laboratoire de Botanique Systematique et d'Ecologie. Lena Borsu-Elgman, and Jean-Paul Mommaerts. Bull Soc Roy Bot Belg. 104 (1): 169-172. 1971.

English summary.
Identifiers: Belgium, Environment, Mirwart,
\*Phytoplankton, Ponds, Short, Trout.

Two trout ponds, one of them being regularly enriched, are compared. The inorganic phosphate content is higher in the enriched pond and a shift from oligotrophy to mesotrophy is observed in the phytoplankton composition.—Copyright 1971, Biological Abstracts, Inc. W72-02807

# SEASONAL DYNAMICS OF MICROBENTHOS OF THE UCHINSKY WATER RESERVOIR, (IN

Moscow State Univ. (USSR). Dept. of Invertebrate Zoology. M. I. Sakharova.

Zool Zh. 49 (12): 1767-1774, 1970. English summary.

Identifiers: \*Benthos, Cyclopoida, Dynamics, Micro, Reservoir, Seasonal, Uchinsky, USSR,

Seasonal changes of microbenthos in the Uchinsky Water Reservoir were studied for 2 yr on different grounds and at different depths (4 stations). The quantitative changes during the year are insignifi-cant; a marked decrease in numbers occurs only in winter (in the drying coastal zone) and in spring (everywhere). Benthic copepodites of pelagic Cyclopoida constitute a significant portion of microbenthos, especially in deeper regions.—Copy-right 1971, Biological Abstracts, Inc. W72-02811 quantitative changes during the year are insignifi-

## TRACE ELEMENTS AND WATER BLOOM (IN

RUSSIAN), Moscow State Univ. (USSR). For primary bibliographic entry see Field 05C. W72-02812

## PRIMARY PRODUCTION OF PHYTOPLANK-TON AND DESTRUCTION OF ORGANIC SUB-STANCES IN THE DUBOSSAR RESERVOIR. (IN RUSSIAN), Kishinev Botanical Garden (USSR).

V. M., Shalar', and G. G. Gorbaten'kii. Gidrobiol Zh. 6 (6): 13-19. Illus. 1970. English summary.

Identifiers: \*Biomass, Destruction, Diatoms, Du-bossar, Organic, Photosynthesis, \*Phytoplankton, Primary, Production, Protococcaceae, Reservoir,

Investigations of the Dubossar reservoir in 1964-Investigations of the Dubossar reservoir in 1964-1966 showed peculiarities of formation and destruction of its primary production in different years and seasons. The intensity of phytoplankton photosynthesis is different at separate areas of the reservoir. With different composition of phytoplankton and unequal transparency of water the greatest content of O2 is produced in the upper part of the reservoir, where diatoms and Protococacaes aleas develop A DIRECT DEPENDENCE. caceae algae develop. A DIRECT DEPENDENCE BETWEEN BIOMASS OF PHYTOPLANKTON AND THE INTENSITY OF PHOTOSYNTHESIS WAS NOT ESTABLISHED.—Copyright 1971, Biological Abstracts, Inc. W72-02813

## CHANGES IN THE DOWNSTREAM INSECT AND AMPHIPOD FAUNA CAUSED BY AN IM-POUNDMENT WITH A HYPOLIMNION DRAIN, Wisconsin Univ., Madison. Dept. of Entomology. William L. Hilsenhoff.

Ann Entomol Soc Amer. 64 (3): 743-746. Illus.

Identifiers: \*Amphipod, Chironomus, Downstream, Drain, Fauna, Gammarus-Pseudolim-Identifiers: naeus, Hypolimnion, Impoundment, \*Insect, Populations, Simulium-Vittatum.

Mill Creek, a small stream in southwestern Wisconsin, was impounded to create a 150-acre recrea-tional lake. This action had a pronounced effect on the insect and amphipod fauna of a rifle 600 ft below the damn, and also affected the fauna of a riffle 2 mi. downstream. Prior to impoundment both riffles were inhabited by a diverse insect fauna that included mostly Ephemeoptera, Trichoptera, Diptera, and Coleoptera. After impoundment the reduction of the number of species in the upstream riffle was highly significant, and previously domi-nant families such as Baetidae (Ephemeroptera). Hydropsychidae (Trichoptera), and Elmidae Hydropsychioae (Trichoptera), and Elimidae (Coleoptera) were replaced mostly by increased populations of Simulium vittatum Zetterstedt (Dip-tera), Gammarus pseudolimnaeus Bousfield (Am-phipoda), and Chironomus and other genera of Chironomidae (Diptera). The impoundment affected the downstream riffle similarly, but to a lesser degree. Large increases in P and N concentrations and increased siltation as a result of impoundment were probably the most important factors in altering the insect and amphipod popula-tions.-Copyright 1971, Biological Abstracts, Inc. W72-02814

## THE EFFECT OF LAS VEGAS WASH EF-FLUENT UPON THE WATER QUALITY IN LAKE MEAD,

Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
D. A. Hoffman, P. R. Tramutt, and F. C. Heller.

Available from the National Technical Information Service as PB-200 137. \$3.00 in paper copy, \$0.95 in microfiche. REC-ERC-71-11, Jan 71, 32p.

Descriptors: \*Nevada, \*Eutrophication, \*Lakes, Water pollution, Degradation, Sewage treatment, Nitrogen compounds, Phosphorus compounds, Reservoirs, Algae, Ground water, Nitrates, Phosphates, Las Vegas Bay. Identifiers: Dissolved organic matter, Las Vegas, Nevada, \*Lake Mead, Las Vegas Bay.

Effluents from the Clark County and Las Vegas, Nev sewage treatment plants are the principal sources of water flowing into Las Vegas Wash. Water in the Wash flows into Las Vegas Bay, an arm of the Boulder Basin reach of Lake Mead. A study was conducted to determine the quality of water in Las Vegas Wash and the effect of that water on the water quality of the lake. Large amounts of total dissolved solids and algae nutrients enter the lake from the Wash.

## Group 2H-Lakes

hlorophyll A values, indicators of algae blooms, were 20e25 times higher in Las Vegas Bay than in the control stations elsewhere in Lake Mead. An unaccountable increase in cations and anions occurs in the Wash. The source of the addition is not known but may be caused by unmeasured ground-water inflow. Methods of collections and analysis for nitrogen and phosphorus are described. W72-02817

DISTRIBUTION PATTERNS AND PARTICLE SIZE OF BOTTOM SEDIMENTS IN THE TSIM-LYANSK RESERVOIR (ZAKONOMERNOSTI GRANU-RASPREDELENIYA I GRANU-GRUNTOV TSIMLYANSKOGO VOI HRANILISHEHA), Rostov-on-Don State Univ. (USSR). For primary bibliographic entry see Field 02J. W72-02857 LOMETRICHESKIY SOSTAV VODOK-

A LAKE AS A NATURAL WATER COMPLEX (OZERO KAK VODNYY PRIRODNYY KOM-

Akademiya Nauk SSSR, Moscow. Institut Geografii. G. S. Shil'krot.

Akademiya Nauk SSSR Izvestiya, Seriya Geograficheskaya, No 2, p 125-130, March-April 1970. 10 ref.

Descriptors: \*Reviews, \*Lakes, \*Bodies of water, \*Aquatic environment, \*Aquatic life, Earth-water interfaces, Air-water interfaces, Littoral, Shallow water, Deep water, Bottom sediments, Organic matter, Topography, Land, Atmosphere, Climatology.
Identifiers: \*USSR, Landscapes, Pelagic.

The geographic literature of the USSR reflects a growing tendency to regard lakes as elements of the natural landscape and of the geographic environment. A lake is a body of water inseparably bound to the adjoining atmosphere and to its bottom. A lake, because it is a natural water complex, is qualitatively different from a natural land complex, and is characterized by a spatial heterogeneity as unique as the development of the factors which form it. Water complexes are different from land complexes but can be seen as analogs of land complexes. Complete natural water complexes include the littoral and pelagic components as expressions of the horizontal differentiation of a water body. Vertical differentiation is expressed by each component of the system, both in the depth of water masses and strata of bottom sediments. Natural water complexes should be viewed as tridimensional systems, which reflect both environmental and hydrodynamic properties. (Josefson-USGS) W72-02858

AN ANALYSIS OF A DEEP-WATER STRUC-TURE FOR THE GREAT LAKES, United States Lake Survey, Detroit, Mich.

B. L. Edge.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 337-346, 1970. 9 fig, 19 ref.

Descriptors: \*Waves (Water), \*Offshore platforms, \*Loads (Forces), \*Pressure, \*Great Lakes, Load distribution. Identifiers: \*Wave forces.

A dynamic wave-soil-structure system was modelled within a probabilistic framework, to properly fulfill the opposing criteria of safety and economy in the design of a deepwater structure. Because waves on the Great Lakes are generally random in nature, the normal mode approach was used to represent the pattern dynamically and stochastically. The Winkler hypothesis was followed to represent the foundation constraints. This approach alleviates the necessity of making invalid

assumptions concerning the fixity of the founda-tion. The phase angle of the deflection varies throughout the structure, and the total deflection is almost directly proportional to the strength of the soil foundation. The spectral density of the response is very sensitive to the natural frequencies of the soil-structure system. (See also W72-01094 thru W72-01112 and W72-02879 thru W72-02890) (Knapp-USGS) W72-02878

SOME EVIDENCE OF METEOROLOGICAL RELATED CHARACTERISTICS OF LAKE SURFACE TEMPERATURE STRUCTURE,

Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland

Waters.
F. C. Elder, and R. K. Lane.
Proceedings Thirteenth Conference on Great
Lakes Research, April 1-3, 1970, State University
College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 347-359,
1970, 106, 2, 24b, 13, 24 (c). 1970. 10 fig, 2 tab, 13 ref.

Descriptors: \*Lake Ontario, \*Water temperature, \*Remote sensing, \*Infrared radiation, \*Water circulation, Density, Density currents, Convection, Limnology, Instrumentation, Mapping, Meteorology, Air-water interfaces.

The surface temperature structure of western Lake Ontario was mapped using an infrared scanner and an infrared thermometer on four days during a six day period in May, 1969. Spatial resoltuion of the infrared scanner gave extreme detail in the surface temperature structure and the repetition on closely spaced days allowed determination of rates of change and persistence of the surface temperature features. Features such as the Niagara River plume were persistent throughout the six day period. However, very detailed patterns showed evidence of banded, cellular, and rotational structure. These features are associated with existence of a convectively unstable layer near the surface, caused by surface heating of water at less than the maximum density temperature. These surface features are present only in the near absence of mechanical mixing and are, therefore, related to the prevailing meteorological conditions. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-02879

STATISTICS OF GREAT LAKES LEVELS.

United States Lake Survey, Detroit, Mich.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International As-sociation for Great Lakes Research, p 360-368, 1970. 6 fig, 2 tab, 8 ref.

Descriptors: \*Water level fluctuations, \*Great Lakes, \*Statistics, Data collections, Water levels, Frequency analysis, Fourier analysis, Distribution patterns. Probability.

Records of monthly mean water levels are available for the Great Lakes from 1860 to the present. The probability distribution of annual as well as monthly mean water-level data is substantially Gaussian. A modified Gaussian distribution using the successive terms of a Gram-Charlier series im proves the representation of the data of all the Lakes. The average and probability distribution are essentially independent of time, although some standard deviations vary with time. The long-term linear trend of these data is insignificantly small and the time series is weakly stationary. Spectral analysis of monthly water-level data in the frequenanalysis of monthly water-level data in the frequency range between zero and six cycles per year show significant peaks of annual cycles in all the Lakes. Spectra obtained by taking differences between the monthly data and the long-term average for the same months do not contain any prominent peaks. Spectral analysis of annual water-level data in the frequency range between zero and one-half cycles per year suggests a long-term periodic cycle of eight years. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-02880

NUMERICAL SIMULATION OF GREAT LAKES

SUMMERTIME CONDUCTION INVERSIONS, Wisconsin Univ., Milwaukee. Dept. of Geography; and Wisconsin Univ., Milwaukee. Center for Great Lakes Studies. W. A. Lyons.

W. A. Lyons.

Proceedings Thirteenth Conference on Great
Lakes Research, April 1-3, 1970, State University
College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 369-387,
1500-15, 50-20 sef 1970. 12 fig, 29 ref.

Descriptors: \*Advection, \*Meteorology, \*Lake Michigan, \*Water temperature, Air temperature, Simulation analysis, Numerical analysis, Profiles, Climatology, Synoptic analysis, Lake breezes, Air circulation, Heat transfer. Identifiers: Lake meteorology.

Warm air advection over the Great Lakes during early summer often occurs with air-water tempera-ture differences as large as 30 deg C, resulting in shallow, but intense, inversions from downward conductive transport. A computer program was developed to solve the heat transfer equation. Tem-perature profiles of advecting air columns are cal-culated as functions of fetch and time from water surface temperature, hourly land air temperatures and lapse rates, wind speed, and an estimated eddy conductivity coefficient. The computed temperature profiles were compared with a wiresonde cross section across Lake Michigan. The layer experiencing conductive cooling greater than 1 deg C rarely ceeds 75-100 m. Extreme inversions of 15 deg C/50 m were computed and confirmed by observation. Daytime superadiabatic layers over land are eradicated and replaced by a stable layer within a 10-20 km fetch. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-02881

WASTE HEAT DISPOSAL IN THE GREAT

Waterloo Univ. (Ontario). Dept. of Mechanical

Brigneering.
G. T. Csanady.
Proceedings Thirteenth Conference on Great
Lakes Research, April 1-3, 1970, State University
College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 388-396,

1970. 2 fig, 10 ref.

Descriptors: \*Mixing, \*Thermal pollution, \*Great Lakes, Heated water, Mathematical models, Path of pollutants, Diffusion, Evaporation, Dispersion, Thermal powerplants, Nuclear power plants

A heat dissipation model was constructed from information available on surface heat flux and turbulent diffusion in the Great Lakes. This model was then used to analyze dissipation of thermal effluents. The energy equation was applied to a flow-ing sheet of water, subject of surface cooling. This reduces to a two-dimensional diffusion equation if the excess temperature is multiplied by an expoten-tial-decay factor. An approximate solution for the diffusion uses Gaussian plumes as elements of a line-source, modelling a power station cooling-water outlet. Comparison of the decay of maximum excess temperature with distance from the source due to surface cooling and mixing shows mixing to be dominant. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-02882

RAPID FLUCTUATIONS OF CURRENT DIRECTION IN LAKE HURON, Waterloo Univ. (Ontario). Dept. of Mechanical

Engineering. G. T. Csanady, and M. Mekinda.

Lakes-Group 2H

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International As-sociation for Great Lakes Research, p 397-412, 1970. 18 fig, 1 tab, 4 ref.

Descriptors: \*Currents (Water), \*Lake Huron, \*Water circulation, \*Density currents, \*Turbulence, Limnology, Diffusion, Mixing, Turbulent flow, Dispersion.

Identifiers: Current fluctuations.

Current direction fluctuations were recorded at a fixed point in Lake Huron during the summer of 1969. Auto-correlations and spectra were obtained, with some data also available for the cross-correlation between two different measuring points. A sharp cutoff was found in spectral intensity, mostly in the decade 1-10 cycles per minute. Some records were markedly periodic, of a period too long to be attributable to surface wave orbital movements, but unexpectedly short for internal waves, suggesting the presence of some very sharp density gradients. (See also W72-01994 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) USGS) W72-02883

## LABORATORY STUDIES IN THE THERMAL

BAR, British Columbia Univ., Vancouver. Inst. of Oceanography. G. H. Elliot, and J. A. Elliot.

O.H. Entot, and J. A. Entot.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 413-418, 1970. 6 fig, 8 ref.

Descriptors: \*Lakes, \*Limnology, \*Thermal stratification, \*Mixing, \*Great Lakes, Diffusion, Advection, Convection, Currents (Water), Water circulation, Thermocline.
Identifiers: \*Thermal bar (Lakes).

The thermal bar phenomenon of large fresh lakes was studied in a quantitative manner in a laboratowas studied in a quantitative manner in a indoratory model. The temperature and velocity fields are similar to those observed in the Great Lakes. The effects of variation of heat input, bottom slope, and initial temperature were studied. A linear physical model gives a reasonable first approximation to the speed of the thermal bar in both the experimental produle and the Great Lakes. A reasonable first approximation is the state of the contraction of the state of model and the Great Lakes. A reasonable first ap-proximation to the heat content of a water column nd the speed of the bar for both the tank and Lake and the speed of the bar for both the tank and Lake Ontario can be obtained from the assumption of negligible horizontal advection and diffusion. In both cases, in the deeper regions, most of the heat is carried by convective processes. These strong vertical convections inhibit horizontal advection and produce the basic features of the thermal bar. The influence of bottom irregularities was tested in two experiments. The main influence was on the speed of the bar; advection produced an averaging effect over the irregularities. Otherwise the temperature and current structure were similar to the others. Thus bottom irregularities would not be considered primarily important in the development of the thermal bar in lakes. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-02884

DYE INJECTION IN THE VICINITY OF THE

THERMOCLINE, Waterloo Univ. (Ontario). Dept. of Mechanical Engineering. A. M. Hale.

A.M. rtaic.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 419-429, 1970. 14 fig, 5 ref.

\*Thermocline, \*Lake Huron, Descriptors: \*Tracers, \*Dye releases, Tracking techniques, Currents (Water), Water circulation, Great Lakes,

Photography, Thermal stratification, Data collec-

During the summer of 1969 a number of experiments utilized Rhodamine B dye, continuously injected at the approximate level of the thermocline in Lake Huron. All of the experiments were conducted when the winds were less than 15 kt. In all cases the position of the source for the experiments was in a region of relatively strong temperature was in a region of relatively strong temperature gradient. The maximum temperature gradient measured was 17 deg C/m. The gradient was usually in the range 4 to 12 deg C/m. The available current data indicate that the region was a shear zone as well. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-02885

LIMNOLOGICAL TOWER FOR 40 M A LIMNOLOGICAL TOWER FOR 40 M DEPTHS, Waterloo Univ. (Ontario). Dept. of Mechanical

Engineering. A. M. Hale.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 430-433,

Descriptors: \*Limnology, \*Equipment, \*Offshore platforms, \*Lakes, \*Towers, Construction, Instrumentation, Design, Data collections, Great Lakes.

The design details and erection procedure are given for a 47 meter long lake research tower (water depth 40 m), which was installed in Lake Huron during 1969. Free-fall anchors were emplaced from a barge. A hinge is located approximately 10 m below the surface to allow the strucmately 10 m below the surface to allow the structure to be removed from the ice-active region at the end of the season. (See also W72-01094 thru W72-01112 and W72-02878 and W72-02890) (Knapp-USGS) W72-02886

SUMMER CIRCULATION PATTERNS NEAR

NINE MILE POINT, LAKE ONTARIO, State Univ. of New York, Albany. Dept. of Atmospheric Sciences.

D. R. Landsberg, J. T. Scott, and M. Fenlon. Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 444-452, 1970. 17 fig, 10 ref. OWRR B-008-NY (6).

Descriptors: \*Lake Ontario, \*Currents (Water), \*Water circulation, Great Lakes, Limnology, Eddies, Path of pollutants, Model studies. Identifiers: \*Lake circulation.

Measurements of current speed and direction by current meter and drogues were obtained in July and August 1969 on three buoy lines located near East Nine Mile Point on the south shore of Lake Ontario. Transport was northeastward, forming a coastal current with speeds from 5 to 40 cm/sec. The speed of this current decreased rapidly below the thermocline. The coastal current was weaker near Nine Mile Point than 10 to 30 km west, because it turns northward near Oswego. A nearshore countercurrent forms an eddy west of Nine Mile Point. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-02887

**FALLOUT RADIONUCLIDES AS TRACERS OF** 

LAKE MIXING, Argonne National Lab., Ill. D. M. Nelson, P. F. Gustafson, and J. Sedlet. D. M. Neison, F. P. Gustatson, and J. Sediet.
Proceedings Thirteenth Conference on Great
Lakes Research, April 1-3, 1970, State University
College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 490-494,
1970. 3 fig, 3 tab. Descriptors: \*Tracers, \*Mixing, \*Lake Michigan, \*Fallout, Great Lakes, Tracking techniques, Currents (Water), Water circulation, Limnology, Tritium, Radioistopes.
Identifiers: \*Lake circulation.

The concentrations of Zr-95, Ru-106, and Ce-144 were determined in eight large samplings of Lake Michigan surface waters between Grand Haven, Michigan-Chicago, Illinois-Milwaukee, Wisconsin on 6 and 7 October, 1969. The samples were collected by forcing approximately one cubic meter of water through an ion exchange resin-filter. The observed uniform horizontal distribution of The observed uniform norman distribution of these fallout nuclides points up their value as tracers of vertical transport within the Great Lakes. Three samples from depths of 25, 30 and 55 (thermocline depth was 17 m) showed concentrations one half to one third those at the surface. The detection of naturally produced Be-7 allows further transport studies to be conducted even in the absence of weapons test debris. Whole water sa ples at various locations and depths were taken for tritium determination, and the uniform results show complete long-term mixing within the Lake. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-02888

NON-LINEAR RESONANCES BETWEEN KEL-VIN WAVES IN LAKE MICHIGAN, United States Lake Survey, Detroit, Mich.

J. H. Saylor.

J. H. Saylor.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 508-528, 1970. 3 fig, 11 ref.

Descriptors: \*Seiches, \*Lake Michigan, \*Ther-mocline, Thermal stratification, Waves (Water), Great Lakes, Mathematical studies. Identifiers: \*Kelvin waves, \*Wave interactions

Solution of the linear, shallow-water wave problem in an infinitely-long, rotating, rectangular channel gives the Kelvin waves as one of the normal-mode seiches. In a linear model, these waves propagate independently of each other but in a non-linear model they interact. Resonances involving three interacting waves were investigated by taking into ac-count the quadratic, non-linear terms. Both surface and internal waves in Lake Michigan have been described previously in terms of Kelvin waves. Rapid, resonant exchanges of wave energy occur between surface waves independent of the internal motions. Possible resonances also involve a pair of oppositely-propagating surface waves with a single internal wave. They occur with internal propagating principally in only one direction along the chan-nel axis. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02890) (Knapp-USGS) W72-02889

MASS OSCILLATION STUDY OF CAYUGA LAKE, N.Y.,
State Univ. of New York, Buffalo. Dept. of Biology.

K. M. Stewart, and R. R. Rumer.

K. M. Stewart, and R. R. Rumer.
Proceedings Thirteenth Conference on Great
Lakes Research, April 1-3, 1970, State University
College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 540-551,
1970. 8 fig, 1 tab, 18 ref.

Descriptors: \*Seiches, \*Water circulation, \*Path of pollutants, \*Lakes, \*New York, Waves (Water), Model studies, Hydraulic models, Currents (Water). Identifiers: \*Cayuga Lake (NY).

Analytical, experimental, and field investigations of the nature of mass oscillation in Cayuga Lake, New York were made in conjunction with a physical model of Cayuga Lake having a horizontal scale ratio of 1:15,000 and a vertical scale ratio of 1:333. Actual prototype data were compared with the

## Group 2H-Lakes

analytical and experimental results. Seichegenerated lake circulation may have a significant effect on the mixing and dilution of liquid wastes introduced into the Lake. Substantive information from the three separate investigations has aided in the understanding of mass oscillations. (See also W72-01094 thru W72-01112 and W72-02878 thru W72-02889) (Knapp-USGS)

THE ROLE OF THE WARM-WATER COM-PLEX OF ZOOPLANKTON DURING THE PERIOD UNDER THE ICE AT SOME IVANO-ARAKHLEISK LAKES, V. P. Gorlachev.

Zap Zabaik Fil Geogr O-Va SSSR. 40. 124-125. 1970. Translated from Ref Zh Biol, 1970, No. 8U130.

Identifiers: Arakhleisk, Asplanchna-Herricki, Asplanchna-Priodonta, Complex, Conochilus-Unicornis, Daphnia-Longispina, Ice, Ivano, Lakes, Period, Plankton, Under, USSR, Warm.

The number of zooplankton during the ice period usually depends on the development of the cold-water aggregation. However, along with the cold-water species, in eutrophic lakes of the Ivano-Alekseisk group considerable development is achieved, especially in Nov. and Dec., by the thermophilic species (Daphnia longispina, Asplanchna herricki, A. priodonta, and Conochilus unicornis). When added together, the cold-water and warm-water complexes may produce a biomass during the ice-over period which exceeds the maximum summer value. Additional studies showed that the thermophilic species develop in winter and produce a population increment, although at very slow rates.-Copyright 1971, Biological Abstracts, Inc. W72-02891

UNIQUE CONDITION UNDER THE ICE OF LAKES OF THE TRANSBAIKAL AND THEIR ROLE IN INCREASING BIOLOGICAL PRODUCTIVITY,

B. A. Shishkin.
Zap Zabaik Fil Geogr O-Va SSSR. 40. 117-119.
1970. Translated from Ref Zh Biol, 1970, No. 811120.

Identifiers: Algae, Biological, Ice, Lakes, Pondweed-M, Productivity, Transbaikal, USSR.

The Ivanovo-Arakhleisk lakes of the Transbaikal are not inferior with respect to most of the variables of biological productivity, and in some cases they even surpass lakes of the European USSR. This is explained by features of the winter regime of the lakes, primarily the large amount of light under the ice. A high level of solar radiation and crystalline ice free of snow cover make possible the winter growth of the phytomicrobenthos, charophytic algae, pondweed, and the like. This growth of vegetation under the ice has a substantial effect on the annual limnological cycle. Large amounts of organic matter are formed in addition to that created in summer, and this has a favorable effect on the production of subsequent trophic levels. It is suggested that the features of the winter regime of the Ivanovo-Arakhleisk lakes are also characteristic of other shallow lakes of the Transbaikal.—Copyright 1971, Biological Abstracts, Inc. W72-02892

METHOD OF CALCULATING PRIMARY PRODUCTION AND DESTRUCTION IN LAKES DURING THE ICE PERIOD,

B. A. Shishkin, and E. I. Bondareva.
 Zap Zabaik Fil Geogr O-Va SSSR. 40. 120-122.
 1970. Translated from Ref Zh Biol, 1970, No. 8U118.

Identifiers: Algae, Calculating, Destruction, Duckweed-M, Ice, Lakes, Method, Mosses, Period, Primary, Production.

Brief descriptions are given of the determinations of the production/destruction coefficient of the bottom vegetation which were used in studying the

methods. The vegetation included ivy-leaved duckweed, charophytic and filamentous algae, and mosses. Also described are the production by the microphytobenthos and the O2 consumption by the bottom.—Copyright 1971, Biological Abstracts, Inc.

A COMPARISON OF PHOTOSYNTHESIS BY PLANKTON IN DIFFERENT LATVIAN LAKES, For primary bibliographic entry see Field 05C. W72-02899

FOOD OF THE CHANNEL CATFISH (ICTALURUS PUNCTATUS) IN A SOUTHERN GREAT PLAINS RESERVOIR.

Oklahoma Cooperative Fishery Unit., Stillwater. Ambrose Jearld, Jr., and Bradford E. Brown. Amer Midland Natur. 86 (1): 110-115. 1971. Identifiers: Catfish, Channel, Detritus, Fish, Food, Great, Ictalurus-Punctatus, Insects, Invertebrates, Plains, Reservoir, Southern.

Stomach contents were examined of 196 channel catfish collected from Oct. 1967 through Aug. 1969. Insects, fish and detritus were most frequently found in the stomachs. Channel catfish smaller than 300 mm (total length) fed primarily on invertebrates. Larger fish were piscivorous.—Copyright 1971, Biological Abstracts, Inc. W72-02906

FISH FROM THE LAKES OF THE TIT-ARY ISLAND AND THEIR USE, Y. P. Larionov.

Tr Yakutsk Otd Sib Nauchno-Issled Inst Rybn Khoz. 3. 164-173. 1969. Translated from Ref Zh Biol, 1970. No. 4192.

Identifiers: Coregonus-Lavaretus-Pidschian, Coregonus-Nasus, Coregonus-Peled, Fish, Island, Lakes, Productivity, Prosopium-Cylindraceum-Leucichthys, Tit-Ary, USSR.

In the Tit-Ari Island on Lena River, there are over 30 lakes of thermo-karst origin with a general area of 500 ha. The nutritional base of the lakes is poor. Seven lakes were studied. Coregonus peled populates nearly all the lakes and is characterized by a slow growth rate. Mass spawning occurs in Nov. Fecundity varies in the range of 14-49.7 thousand. C. lavaretus pidschian was found in 5 lakes where it prevailed over other fish. Its spawning occurs earlier than in C. peled. C. nasus inhabits all of the studied bodies of water and for spawning goes into the river. Prosopium cylindraceum constantly inhabits and spawns in the lakes from Oct. 15 to Nov. 1. Biccundity is 7.3 to 10.7 thousand eggs. Fish of the subgenus Leucichthys of the genus Coregonus were found in 2 lakes. Fish productivity of the studied lakes was 3-4 kg/ha.—Copyright 1971, Biological Abstracts, Inc. W72-02908

THE LIFE HISTORIES AND TROPHIC RELA-TIONSHIPS OF THE TRICHOPTERA OF MARION LAKE, BRITISH COLUMBIA, British Columbia Univ., Vancouver. Inst. of Animal

Resources and Ecology. For primary bibliographic entry see Field 05C. W72-02919

AN ECOLOGICAL STUDY OF BANKSIOLA CROTCHI BANKS (TRICHOPTERA, PHRYGANEIDAE) IN MARION LAKE, BRITISH COLUMBIA,

British Columbia Univ., Vancouver. Inst. of Animal Resources and Ecology. Michael J. Winterbourn.

Can J Zool. 49 (5): 637-645. Illus. 1971. Identifiers: Banksiola-Crotchi, British-Columbia, Budget, Canada, Ecological, Energy, Feeding, History, Lake, Larval, Life, Marion, Phryganeidae, Trichoptera.

The life history and feeding relationships of larvae of the phryganeid caddisfly B. crotchi were investigated in Marion Lake, British Columbia. Eggs were laid on submerged vegetation in fail, larval growth was rapid in fall and spring, and adults were present from July to Sept. Larvae in instars 2 to 4 fed primarily on filamentous algae but in the final (5th) instar, and to a lesser extent in the 4th, larvae were predaceous. Feeding rates of larvae were examined in the laboratory and the efficiency with which algae were used as food was investigated. A larval energy budget was constructed from field and laboratory data.—Copyright 1971, Biological Abstracts, Inc. W72-02920

## 2I. Water in Plants

FLORA AND FAUNA OF THE LAPTICI PEAT-BOG IN THE BUCEGI MOUNTAINS,
Inst. Biol. 'Traian Savulescu,' Bucharest, Rom.

Stoica Godeanu. Ocrotirea Natur. 14 (1): 41-48. Illus. 1970. English summary.

Identifiers: Bog, Bucegi, Fauna, Flora, Laptici, Mountains, Peat, Romania.

A comprehensive study was made of Laptici, the only peat-bog in the Bucegi Mountains. The georaphical situation, geology, flora and vegetation are presented according to bibliographic data. The ranges of variation of the chemical composition of the waters are presented for the 1st time. The plant and animal spp. in the waters are listed, as well as the animals in the brooks which cross the peat-bog. Although it is small and isolated from the Romanian areas with many large peat-bogs, its flora has some rare northern spp. and its fauna is rich and differs from other peat-bogs. The fauna of the brooks crossing it have usual mountain spp. The mutual influence between the peat-bog and the environment is analyzed.—Copyright 1971, Biological Abstracts, Inc. W72-02449

THE ECOLOGY AND DISTRIBUTION OF PROMENETUS EXACUOSUS SAY (GASTROPODA:PLANORBIDAE) IN SOUTHERN MANITOBA.

Manitoba Univ., Winnipeg. Dept. of Botany. Eva Pip, and William F. Paulishyn. Can J Zool. 49 (3) 367-372. Illus. Maps. 1971. Identifiers: Canada, Distribution, Ecology, Gastropoda, Manitoba, Planorbidae, Promenetus-Exacuosus, Southern, Sulfate, Temperature.

Promenetus exacuous inhabits limited environments in southern Manitoba. Shallow water depth and vegetation seem to be important factors affecting geographic distribution. Except for extremes, temperature, substrate, and type of water body appear to have little effect. P. exacuous generally appears to prefer water with relatively low sulfate concentrations. The effect of sulfate concentration on population fluctuation is not well understood. Several other gastropods are usually associated with P. exacuous, but none duplicates its distribution in southern Manitoba.—Copyright 1971, Biological Abstracts, Inc.

STUDIES ON THE ACTINOMYCETES FOUND IN THE OOZE OF SOME GLACIAL LAKES, (IN FRENCH).

C. Moruzi, and I. Balinschi.

Rev Mycol (Paris). 34 (5): 376-384. Illus. 1970. English summary.

English summary. Identifiers: Actinomyces-Alboflavus, Actinomyces-Annulatus, Actinomyces-Candidus, Actinomyces-Globisporus, Actinomyces-Griseus, Actinomyces-Longisporus, Actinomyces-Mirabilis, Actinomyces-Roseolus, Actinomycets, Glacial, Lakes, Ooze. Romania.

Eight species of actinomycetes (Actinomyces candidus, A. griseus, A. globisporus, A. alboflavus, A. longisporus, A. roseolus, A. mirabilis and A. annulatus) isolated from the mud and sand of 4 lakes of glacial origin (Bucura, Zanoaga, Galesul and Suri-anul) are discussed. All of them are new in the microflora of the Socialist-Republic of Romania. The results of research into the morpho-biochemistry and the antagonistic action of these species are presented.—Copyright 1971, Biological Abstracts, Inc.

CILIATA OF THE BOTTOM OF REARING FISHPONDS IN THE GOLYSZ COMPLEX, Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.

Elzibieta Grabacka.

Acta Hydrobiol. 13 (1): 5-28. Illus. 1971. (Pol.

Identifiers: Bottom, Ciliata, Complex, Fertilizers, Fishponds, Golysz, Poland, Rearing.

In 1963-1964 investigations were carried out on the microfauna of the bottom mud of 10 artificial fishponds of the Golysz Complex of Experimental Farms with particular attention to the Ciliata. Qualitative (184 Ciliata spp. reported) as well as quantitative studies in which the variations in the numbers of the Ciliata population during the whole growing season were noted. The most abundant garding season were noted. The most abundant and greatly varied microfauna was found in the ponds of the Golysz Farm, which had been intensively manured with mineral (composite) fertilizers.—Copyright 1971, Biological Abstracts, Inc. W72-02516

ROLE OF XYLEM PARENCHYMA IN MAIN-TAINING THE WATER BALANCE OF TREES, Szkola Glowna Gospodarstwa Wiejskiego, Warsaw (Poland). Dept. of Forest Botany.
T. J. Wodzicki, and C. L. Brown.

Acta Soc Bot Pol. 39 (3): 617-622. 1970. Identifiers: Balance, Maintaining, Parenchyma, Trees, Xylem.

Even though much more research needs to be done on the role of living cells in maintaining the water balance of trees, it appears that the cohesion-trans-pirational forces operating during successive diur-nal cycles can be maintained indefinitely only when alternating with the often obscure but equally im-portant functions of living cells.--Copyright 1971, Biological Abstracts, Inc. W72-02540

AN ANNOTATED LIST OF STREAM INVER-TEBRATES COLLECTED FROM GRAND TETON NATIONAL PARK, WYOMING, Wyoming Univ. Laramie. Dept. of Zoology. Richard L. Kroger. Univ Wyo Publ. 36 (1): 1-14. Map. 1970.

Identifiers: Annotated, Collected, Grand, Invertebrates, List, National, Park, Stream, Teton,

This annotated list (188 forms) is based upon the analysis of 310 Surber footsquare, 96-hourly drift, and a large number of qualitative samples of the major invertebrates from large streams in Teton major invertebrates from large streams in Teton County, Wyoming, USA. Description of the Snake River and tributatires and habitats yielding the samples are discussed. Abundance estimates are given for each taxon.—Copyright 1971, Biological Abstracts, Inc. W72-02558

OXYGEN REGIME OF CUCURBITA PEPO ROOTS IN WATER CULTURES, (IN RUSSIAN), Akademiya Nauk SSSR, Moscow. Inst. of Plant

Physiology.
B. B. Vartapetyan, and N. G. Davtyan.
Agrokhimiya 5. 93-96. Illus. 1970.
Identifiers: Cucurbita-Pepo-D, Cultures, Oxygen, Polarography, Regime, Roots.

The polarographic method of determining oxygen made it possible to explain the topography of distribution and consumption of oxygen in the rhizosphere of plants under conditions of water cultures. Findings very graphically demonstrate that the usually accepted forms of aeration of roots in working with water cultures are much lower than the optimal conditions for the oxygen supply of roots. Results of this study should be applied for growing plants in water cultures and for developing the optimal oxygen regime for roots in hydroponics.—Copyright 1971, Biological Abstracts, Inc. W72-02559

GROWTH AND DEVELOPMENT OF QUERCUS ROBUR L. IN PURE AND MIXED NEST CULTURES ON LARGE HOLLOWS OF THE CASPI-AN LOWLANDS, (IN RUSSIAN),

B. A. Osokin.

B. A. Osokin.

Uch Zap Leningrad Gos Pedagog Inst Im A I Gertsena. 333: 198-205. 1968.

Identifiers: Amelanchier-D, Apple-D, Ash-D, Caspian, Competition, Cultures, Currant-D, Development, Growth, Height, Hollows, Lowlands, Maple-D, Mixed, Nest, Oak-D, Pure, Quercus Robur-D, Root, Serviceberry-D, Stands, Tatarian, 1155B

Investigations were conducted on 11-13-yr-old oak Investigations were conducted on 11-13-yr-old oak stands. The mixture types were the following: pure nest sowing of oak, oak-serviceberry (Amelanchi-er)-ash, -oak; 3-oak-currant-apple-currant-oak; 4-oak-Tatrain maple-oak. Depending on the mixture type, the root systems of oak penetrated to a depth of 360-520 cm and the mean height varied from 330 to 470 cm. Best height and survival/unit area of oak occurred in a mixed stand with Tatarian maple. Delayed growth of oak in mixed stand with maple. Delayed growth of oak in mixed stand with currant and apple, occurs because of root competi-tion by the roots of currant. Oak roots develop better with soil cultivation according to the clear fallow system. The root system of oak growing with Tatarian maple, ash and serviceberry is not adver-sely affected by those of the associated species, although the total volume of oak roots is reduced in such a mixture by half. Intense root and top growth of maple, serviceberry, and ash intensified the dif-ferentiation of oak. In regions with dry climate, nest sowings of oak with dense planting of associated species are not suitable because they disturb the water regime of oak and delay its growth.—Copyright 1971, Biological Abstracts, Inc. W72-02564

ROOT DISTRIBUTION OF A PLANTATION-GROWN RED PINE IN AN OUTWASH SOIL,

Syracuse Univ., N.Y.

Albert L. Leaf, Raymond E. Leonard, and John V.

Bergind.
Ecology 52 (1): 153-158. Illus. 1971.
Identifiers: Distribution, Grown, Outwash, Pine-G, Pinus-Resinosa-G, Plantation, Red, Root, Soil.

Root distribution and mass of a single dominant sample tree (17 m high, 20 cm diameter) in a 39-yr-old Pinus resinosa Ait. plantation supported by a deep, stratified, outwash sandy soil were related to soil horizonation characteristics and above ground tree components (foliage, branches, bolebark, and bolebark, and bolewood). Root-depth penetration bolebark, and bolewood). Root-depth penetration terminated in a great number of fine roots in a thick, very fine sandy-silty stratum below the coarser textured solum at 2.7 m. Lateral root distribution was extremely variable; the maximum radial extent was approximately 9 m from the stump. Total root weight was approximately twice the total needle weight.--Copyright 1971, Biological Abstracts, Inc. W72-02569

SOME OBSERVATIONS ON THE BIOLOGY AND LIFE-HISTORY OF NANDUS NANDUS (HAMILTON), Central Inland Fisheries Research Inst., Hazaribagh

(India). Central Inland Fisheries Research Unit. S. Parameswaran, S. Radhakrishnan, and C. Selvarai.

Proc Indian Acad Sci Sect B. 73 (3): 132-147. Illus.

Identifiers: Biology, Breeding, Egg, History, Incubation, Life, Nandus-Nandus, Nursery, Pest, Pond.

In Assam, the minor predatory fish, N. nandus (Hamilton), matures by the middle of March and its breeding season extends from late March to the middle of July. The sexes can be distinguished externally during the breeding season, by the difference in the general coloration. The mature ovarian eggs measure 0.595 to 0.663 mm in diameter. The fecundity of the fish (length range: 75 to 138 mm) ranged from 1573 to 23,546. Mature fish were induced to breed by the administation of carp pituitary hormones and the life-history, from the 1st cleavage to 11,328 mm post-larva, was studied. The fertilized, swollen eggs, having an average The fertilized, swollen eggs, having an average diameter of 0.799 mm, are spherical, adhesive and yellowish in color with a central, spherical oil globule. At a water temperature of 20 to 22.3C, the period of incubation is about 36 to 37 hr. The period of incubation is about 36 to 37 hr. The newly hatched larva measuring 2.070 mm in length has 3 characteristic vertical bands and pigmented eyes. It is devoid of mouth and pectoral fins. In the 4 days' old larva, measuring 3.291 mm in length, the yolk is completely absorbed. The fins are fully formed and all the adult characters attained, when the post-larva is about 19 days' old and measures 11.328 mm in length. The fish has a planktonic feed in the post-larval stage. It is predominantly insectivorous and piscivorous in dietary habits in the juvenile and adult stages respectively. The predatory habit of the fish warrants its eradication from unsrery ponds.—Copyright 1971, Biological Abnursery ponds.--Copyright 1971, Biological Abstracts, Ir W72-02570

ECOLOGICAL STUDIES IN THE PLANKTON OF CERTAIN FRESHWATER PONDS OF HYDERBAD-INDIA: II. PHYTOPLANKTON: I, Osmania Univ., Hyderabad (India). Dept. of

Hydrobiologia. 37 (1): 55-88. Illus. 1971.

Hydrobologia, 17(1), 238-1103. 1911. Identifiers: Chorococcales, Desmids, Ditaoms, Dissolved, Ecological, Fresh, Hyderabad, India, Nitrates, Oxygen, pH, Phyto, Plankton, Pollution, Ponds, Volvocales.

The distribution and periodicity of Volvocales, Chlorococcales, Desmids, Euglenineae and other phytoplankton is discussed. Of the 3 ponds studied, the polluted pond had the densest population comprised of Volvocales, Chlorococcales, Myxophyceae and Euglenineae. Blue-greens were particularly abundant in alkaline waters (pH 8.69) which were rich in nitrates and dissolved oxygen. The ponds with diatoms and desmids were less polluted. Attention was paid to the ecology of individual species as far as possible.—Copyright 1971, Biological Abstracts, Inc. W72-02572

CERTAIN PROBLEMS CONCERNED WITH THE METHODS OF ESTIMATING THE BIOMASS OF PHYTOPLANKTON, (IN RUS-SIAN).

Akademiya Nauk SSSR, Leningrad. Botanicheskii Institut.

I. V. Makarova, and L. O. Pichkily. Bot. Zh. 55 (10): 1488-1494. Illus. 1970. Identifiers: Aral, Biomass, Cell, Methods, Phyto, Plankton, Sea, Shape, USSR, Weight.

Data from literature on the method of determining the biomass of phytoplankton is given. On the basis of original material from the study of phytoplankton in the Aral Sea, weights and cell shapes are given for 141 algae.—Copyright 1971, Biological Abstracts, Inc. W72-02576

CLADIETUM MARISCI (ALL. 1911) ZOBRIST 1935 IN NORTHEASTERN POLAND, Wyzsza Szkola Rolnicza, Olsztyn-Kortowa (Po-land). Faculty of Agriculture.

## Group 21-Water in Plants

Benon Polakowski. Fr Florist Geobot (Krakow). 15 (1): 85-90. 1969. Identifiers: Alnus-D, Carex-M, Cladietum-Marisci, Cladium-Mariscus-M, Phragmites-M, Poland, Scheuchzeria-M.

Results of phytosociological ivestigations on the plant association Cladietum marisci in NE Poland (1963-1966) are discussed. Although this region is located outside of the geographical area in which Cladium mariscus occurs densely, it is found in 9 locations. C. mariscus formed typical regional associations of reeds usually as a result of the penetration of C. mariscus into open water or the displacement of Scirpo-phragmitetum by C. mariscus. Species from the order Phragmitetalia, class Phragmitetea and species from the order Scheuchzerietalia palustris, class Scheuchzerio-Caricetea fuscae and Alnetea glutinosae form the principle plant associations. The number of swamp species is directly proportional to the water level and thus leads to the complete displacement of Cladietum marisci by Caricetum hudsonii and Caricetum lasiocarpae and by Carici elongatae-Alnetum.—Copyright 1971, Biological Abstracts, Inc. W72-02578

NONSYNCHRONIZED OSCILLATIONS IN STO-MATAL RESISTANCE AMONG SCLEROPHYLLS OF EUCALYPTUS UMBRA. Melbourne Univ., Parkville (Australia). School of

Botany. C. T. Teoh, and J. H. Palmer. Plant Physiol. 47 (3): 409-411. Illus. 1971. Identifiers: \*Eucalyptus-Umbra-D, Moisture, Nonsynchronized, Oscillations, Resistance, Sclerophylls, Soil, Stomatal, Stress

Oscillations in stomatal resistance to viscous air flow were recorded in the juvenile and adult sclerophylls of Eucalyptus umbra R. T. Baker, in both controlled and natural environments. Under constant illumination, temperature, and humidity, irregular oscillations in stomatal resistance with a periodicity of approximately 20-30 min occurred spontaneously, when the soil water potential was approximately -0.2 bar. In the natural summer environment, similar stomatal oscillations developed with periods, ranging from 60 to 100 min only after imposition of soil moisture stress equivalent to -2 to -3 bars water potential. These cycles in stomatal resistance were not synchronized among the leaves of a given plant in any of the experiments.—Copyright 1971, Biological Abstracts, Inc. W72-02637

## VIMBA VIMBA L. FROM THE DANUBE BASIN

IN POLISH WATERS, Polskie Towarzystwo Przyrodnkow im Kopernika, Warsaw.

Zbigniew Wajdowicz.

Wszechswiat. 9. 234-236. Illus. 1970.

Identifiers: Basin, Danube, Migration, Polish, Vimba-Vimba.

A variety of fish occurring in the Czarna Orawa River was identified as V. vimba, natio carinata L. It is common in rivers of the basins of the Black Sea, Caspian Sea and Sea of Azov. Following the change of its natural habitat, the fish was seen to migrate up the Czarna Orawa River. The spawning season usually begins by mid-May, but it is most effective at higher temperatures, that is at the end of May or early June. Introduction of the fish into other rivers of the Baltic Sea Basin is possible.--Copyright 1971, Biological Abstracts, Inc. W72-02670

## ECOLOGICAL ENERGETICS AND NATURAL HISTORY OF HEDRIODISCUS TRUQUII (DIP-TERA) IN TWO THERMAL SPRING COMMU-

NITIES, Fisheries Research Board of Canada, Winnipeg (Manitoba), Freshwater Inst.

J Fish Res Board Can. 28 (1): 73-94. Illus. 1971.

Identifiers: Algal, Communities, Diptera, Ecological, Energetics, Export, Fauna, Flora, Hedriodiscus-Truquii, History, Natural, Predation, Spider, \*Spring, Thermal.

The interrelations of flora and fauna of the Ohanapecosh Hot Springs, Mount Rainier National Park, Washington State, were studied during a 4-yr period commencing in 1963. The flow of energy and efficiency of its transfer were measured in 2 springs, one with an annual mean temperature of 35 C (SD 2.0) and the other a constant 47 C. In addition to temperature differences, each spring contained a different flora and fauna. Primary produc-tion estimates were obtained together with data relative to many aspects of the natural history of the dominant dipteran herbivors H. truquii (Bellardi), hitherto undescribed in the larval stage, and common to both springs. Aspects of the natural history of Hedriodiscus pertianent to the energetic aproach are discussed, including a detailed caloric investigation. Information about the seasonal variainvestigation. Information about the seasonal varia-tion in lipid composition during larval growth was used to explain much of the observed caloric varia-tion. Energy budgets for 3 of the 4 instars of Hedriodiscus were determined from estimates of growth, respiration, and rates of food ingestion. growth, respiration, and rates of tool ingestion. This information together with population census data permitted calculation of population energy budgets. Efficiencies of energy transfer in both spring communities are compared and discrepancies in the allocation of assimilated energy between cies in the allocation of assimilated energy between populations are attributed to variation in diel behavior patterns and differences in food ingested. Export of Hedriodiscus larvae and spider predation on newly emerged adults inflicted heavy mortality and were considered the most important sources of population regulation. The annual energy balance for the 2 springs was tabulated from estimates of energy income and export. The springs fixed far more energy than was expended in any given year. Greatest losses are attributed to algal export. respiration, and travertine deposition; tree leaves represented a significant income of energy to the springs. Primary production accounted for better than 90% of total income and only 0.5-1.0% of algal primary production was channeled to the dominant herbivore, Hedriodiscus. Of algal gross tommant nervote, rearrouseus, of again grows production 20-25% was exported from the system. Photosynthetic efficiency was 1.06% utilization of visible light available to algae.—Copyright 1971, Biological Abstracts, Inc. W72-02692

# THERMAL REGULATION OF WATER UP-TAKE BY GERMINATING HONEY MESOUITE

Texas Tech. Coll., Lubbock. Dept. of Range

C. J. Scifres, and J. H. Brock.

C. J. Scirres, and J. H. Brock.
J Range Manage. 24 (2): 157-158. Illus. 1971.
Identifiers: Germinating, Honey, \*Mesquite-D,
Prosopis-Glandulosa-Var-Glandulosa-D, Regulation, Seeds, Temperature, Thermal, Uptake,

Ambient temperature regulated the rate and extent of water imbibition by germinating honey mesquite (Prosopis glandulosa Torr., Var. glandulosa) seeds. Honey mesquite seeds required less water and less time for germination at 85 deg than at 100 deg or 70 deg F. Seeds at 70 deg F contained almost 3 times as much water as seeds at 85 deg F when germination first occurred although the rate of water. times as much water as seeds at 85 deg F when germination first occurred although the rate of water uptake (mg/seed/hr) was reduced considerably. Decreasing moisture availability to 8 atm influenced the rate of water absorption by seeds more at 85 deg and 100 deg F than at 70 deg F.—Copyright 1971, Biological Abstracts, Inc. W72-02693

## ESTABLISHMENT OF SUBCLOVER IN RELA-TION TO NODULATION, TIME OF SEEDING, AND CLIMATIC VARIATION.

California Univ., Hopland. Hopland Field Station. Milton B. Jones, Patrick W. Lawler, and Alfred H.

J Range Manage. 24 (2): 147-150. 1971.

Identifiers: Climatic, \*Clover-D, Inoculum, Nodu-lation, Rainfall, Relation, Seeding, Sub, Survival, Temperature, Time, Trifolium-Subterraneum-D,

Pellet inoculated subclover (Trifolium subterraneum) seed planted at various autumn dates on a site where effective nodulation was known to be a where effective nodulation was known to be problem, produced healthy plants when mean ambient air temperature in the 6 wk following germination was between 49 deg and 62 deg F. When mean temperature for the 6-wk period was about 45 deg F, very poor clover stands developed. Seed planted Sept. 10, about 1 mo. before a rain, produced a good stand of vigorous clover. This in-dicated that sufficient viable inoculum survived in dry soil on the pelleted seed until the rains came. Where subclover is adapted, plantings may be made in Oct. rather than waiting until the soil is wet. More vigorous clover grew from seed which was in the ground at the time of the 1st rain than from seed drilled soon after the rain.—Copyright 1971, Biological Abstracts, Inc. W72-02694

# RATIO OF PROTEINS, LIPIDS, AND CAR-BOHYDRATES IN FRESHWATER ZOOPLANK-

TONS,
Centre National de la Recherche Scientifique, Gifsur-Yvette, (France). Centre de Recherches
Hydrobiologiques.
R. Pourriot, and L. Leborgne.
Ann. Hydrobiol. 1 (2): 171-178. 1970. (Engl.

Identifiers: Carbohydrates, Crustacea, Lipids, Planktons, Proteins, Ratio, Rotifera.

Classical methods for the determination of proteins, lipids and carbohydrates were applied to the study of the chemical composition of freshwater zooplanktons. Five plankton samples of Crustacea and Rotifera were analyzed. The mean values obtained, expressed as percentage of the sum of the 3 organic compounds, are: 57% of proteins, 36% of lipids and 7% of carbohydrates. The results are discussed and compared with other literature data.—Copyright 1971, Biological Abstracts, Inc. W72-02697

## AN INTRODUCTION TO THE BIOLOGY OF CRANEFLIES IN A SERIES OF ABANDONED BEAVER PONDS, WITH AN ACCOUNT OF THE LIFE CYCLE OF TIPULA SACRA ALEX-ANDER (DIPTERA; TIPULIDAE),

Calgary Univ. (Alberta). Dept. of Biology.
G. Pritchard, and H. A. Hall.
Can J Zool. 49 (4): 467-482. Illus. 1971.
Identifiers: Abandoned, Beaver, Biology, Crane,
Cycle, Diptera, Flies, Life, Ponds, Series, TipulaSacra, Tipulidae.

A series of 5 beaver ponds that have been abandoned for about 10 yr is described, and an introduction to the ecology of the area is given. The life cycle of the cranefly T. sacra is described. This is the commonest cranefly in the area and the larvae are important grazers on the microflora in benthic sediments. There are 4 larval instars, which can be separated by a combination of the presence of absence of setae on the spiracular lobes and the size of the spiracles. Larvae in instars III and IV can be sexed by examination of the gonads, while the presence of growth lamellae on the lateral sclerites of the head capsule shows promise as a means of aging larvae in all instars.--Copyright 1971, Biological Abstracts, Inc. W72-02719

# ANNUAL CYCLE OF LEAF WATER POTENTIAL IN PICEA ENGELMANNII AND ABIES LASIOCARPA AT TIMBERLINE IN WYOM-

ING, Duke Univ., Durham, N.C. Dept. of Botany. J. H. Lindsay. Arctic Alpine Res. 3 (2): 131-138. Illus. 1971. Identifiers: Abies-Lasiocarpa-G, Annual, Bow, Cold, Cycle, Leaf, Medicine, Mountains, Picea-Engelmannii-G, Potential, Soil, Timberline, Wind, Wyoming.

eaf water potential of Picea engelmannii and Abies lasiocarpa was measured throughout the year in the Medicine Bow Mountains, Wyoming, Winter-exposed needless of trees at timberline (3300 m) exhibited severe water stress during the winter (-30 to -35 bars water potential) while winter-protected needless of trees at timberline and winter-protected needless of trees at timberline and needles of trees at lower elevations (2990 m) exhibited less stress (-18 to -20 bars water potential). The winter stress of the timberline trees appeared to be the result of the interaction of primarily 2 factors, the strong winds which increased transpirational losses and the cold soil which inhibited abtonal issess and the coin soil which immotive assorption of water. Leaf water stress appears to be a significant limiting factor of tree growth at timberline in the central Rocky Mountains.—Copyright 1971, Biological Abstracts, Inc. W72-02723

EFFECT OF MOISTURE STRESS ON METABOLIC PRODUCTS AND IONS ACCU-

MULATION, Cairo Univ. (Egypt). Faculty of Science. A. A. Abdel Rahman, A. F. Shalaby, and El M. O. Monayeri.

Plant Soil. 34 (1): 65-90. Illus. 1971.

Identifiers: Accumulation, Carbohydrate, Forage, Ions, Metabolic, Moisture, Nitrogen, Plants, Products, Soil, \*Stress, Water

Estimations of the metabolic products and accumu lated ions were made at the different stages of development of native and introduced plant species grown under different levels of water supply equivalent to 125, 200, 275 and 350 mm. The increase in moisture stress favored the increase in total available carbohydrates and total N. With deficiency in soil moisture K, Na, Ca, Mg, and Cl ions increase and P and Fe ions decreased. The total ions accumulated in the plant tissues in-creased with decrease in soil moisture and rise in moisture stress. This was accompanied by accumulation of more salts in the cell sap and the consequent rise in osmotic pressure. Forage plants subjected to higher moisture tension were richer in total N, total available carbohydrates. Ca, and Mg and poorer in P content. The total nutritive value is not only determined by the percentage of these constituents but also by the dry matter production/plant, the latter greatly suppressed with deficiency in soil moisture.—Copyright 1971, Biological Abstracts, Inc. W72-02726

A MANUAL FOR THE STUDY OF MEIOFAU-

American Univ., Beirut (Lebanon). Dept. of Biolo-

gy. Neil C. Hulings, and John S. Gray. Smithson Contrib Zool. 78. 1-83. Illus. 1971. Identifiers: Fauna, Manual, Meio, Methods,

Procedures and methods for the study of meiofauna are presented in terms of general description of the habitat, environmental analyses, general col-lecting and extracting techniques, general tax-onomic procedures, comments on selected taxa, and culture and experimental techniques. Biotopes other than sediment are considered briefly and ounces of equipment are considered briefly and sources of equipment and materials for the study of meiofauna are listed. A total of 361 references dealing with various aspects of meiofauna are given.—Copyright 1971, Biological Abstracts, Inc. W72-02727

TREES AS WATER COLLECTORS ON THE

SEMIDESERT, Royal Coll. of Forestry, Stockholm (Sweden).

Vadim Soderstrom. Sveriges Skogsvardsforb Tidskrift. 66 (5): 427-432.

Identifiers: Caragana-D, Collectors, Conservation, Desert, Fraxinus-D, Management, Pyrus-D, Ribes-D, Robinia-D, Semi, Soil, \*Trees, Ulmus-D, Water,

In an area east of Volgagrad with an annual precipitation of 250 - 350 mm and an evaporation capacity of 1000 mm, water is conserved by the snow screen effect of a network of tree belts, 10 -20 m broad, enclosing quadrangular fields, 300 - 400 m long. The soil is plowed to a depth of 50 - 60 cm, then hedges of Ulmus, Fraxinus, Robinia, Pyrus, Ribes and Caragana are planted for snow collection in the winter; weeks are removed 4 - 5 times/yr. A few years later, oak and pine and, occasionally, birch are planted in rows. The tree belts prevent wind erosion and enable a net increase in wheat production of 300 - 400 kg/yr/ha.—Copyright 1971, Biological Abstracts, Inc. W72-02738

FLOODING AND REGENERATION OF RIVER RED GUM, EUCALYPTUS CAMALDULENSIS

Forests Comm. Victoria, Melbourne (Australia). B. D. Dexter.

Forests Comm Victoria Bull. 20. 3-35. Illus. Map. 1968.

Identifiers: Australia, Competition, Eucalyptus Camaldulensis-D, \*Flooding, Grazing, Gum-L Moisture, Red, Regeneration, River, Soil, Weed.

Regeneration in the Barmah State Forest in rthern Victoria has been difficult due to variable rootinern victoria has been difficult due to variable flooding, unfavorable seed-beds, inadequate seed supply, and soil drought induced by high evaporative losses and competing vegetation. Useful germination appears on unflooded areas only in winter and early spring during periods of regular rainfall. Water temperatures during winter are generally un-favorable for germination on flooded sites, but germination is prolific following flood recession in spring. Soil moisture and seed-bed conditions are e main determinants of seedling establishment. Grazing aids seedling establishment by reducing weeds and grasses that compete with seedlings for soil moisture.—Copyright 1971, Biological Abstracts. Inc. W72-02739

EFFECTS OF RESERVOIR CONSTRUCTION ON NATURE AND THE ECONOMY (VOPROSY FORMIROVANIYA VODOKHRANILISHCH I IKH VLIYANIYA NA PRIRODU I KHOZYAYSTVO).

Perm State Univ. (USSR). Lab. of Water Management Research. For primary bibliographic entry see Field 06G. W72-02775

FUNCTIONING OF AN ECOSYSTEM ON THE LEVEL OF PRIMARY PRODUCTION: MEA-SUREMENTS CARRIED OUT ON A CROP OF HELIANTHUS ANNUUS (IN FRENCH), Centre National de la Recherche Scientifique,

F. E. Eckardt, G. Heim, M. Methy, B. Saugier, and

R. Sauvezon. Oecol Plant. 6 (1): 51-100. Illus. 1971. English

summary.
Identifiers: Carbon, Crop, Ecosystem, Functioning,
Measurements, \*Helianthus-Annuus-D, Measurements, Photosynthesis, Primary, Production, Respiration, Stress, Uptake, Water,

The aspects studied were: interception of radiant energy by the plant cover, energy conversion in photosynthesis, use of products of photosynthesis in building up of biomass with special reference to radiant energy intercepting organs and respiration involved in maintenance and growth. Emphasis was given to effects of water stress on these system characteristics considered separately and as a whole. Four methods were used: the energy balance method, the cuvette method with automatic control of the CO2 concentration, tempera ture and humidity of the air, growth analysis and

mathematical modeling. Good agreement of results was obtained when applying these methods to the determination of C uptake by the ecosystem from the lower atmosphere during the day. During the vegetative phase and until the end of flowering, dry matter production and fixation of chemical energy are proportional to the fixation of C; from then on, dry matter production is reduced and energy fixation increased in relation to C fixation. tion increased in relation to C fixation.

Photosynthesis expressed as a function of leaf surface area is not affected by water stress and no afternoon depression was observed. The plants reacted to drought by restricting leaf surface development.—Copyright 1971, Biological Abstracts, Inc. W72-02788

GROWTH OF PERENNIAL RYEGRASS (LOLI-UM PERENNE L.) IN RELATION TO WATER, NITROGEN, AND LIGHT INTENSITY, Illinois Univ., Urbana. Dept. of Agronomy.

R. J. Luxmoore, and R. J. Millington.

Plant Sail 44 (2) 260 - 281 | 1811 - 1922

Plant Soil. 34 (2): 269-281. Illus. 1971.

Light, Lolium-Perenne-M, Nitrogen, Perennial, Relation, \*Rye, Tillering, Water, Weight.

Lolium perenne, cultivar 'New Zealand Mother' was grown in sand pot culture in a controlled-en-vironment cabinet. Three N treatments, 2 water levels and 2 light intensities were applied in factorial arrangement and the plants were harvested at 33, 46, and 60 days from germination. The responses of dry weight, tiller number, and leaf area to the ents were examined. The treatment effects on total leaf area at the final harvest were related to variation in both tiller number and the size of new and expanded leaves. There were no effects on the average number of either new or expanded leaves per tiller. Variation in total dry weight at the final harvest was related to treatment effects on both tiller number and the mean dry weight per tiller. Tiller weight increased with higher light intensity and higher water level, but decreased with added N. The relative distribution of dry matter between leaves, sheaths and roots was greatly influenced by the treatments. Tillering responded markedly to change in light intensity, N and water supply, and variation in tiller number was the major morphological response of perennial ryegrass associated with variation in total dry weight and leaf area.—Copyright 1971, Biological Abstracts, Inc. W72-02795

MOISTURE INTERCEPTION AS A FACTOR IN THE COMPETITIVE ABILITY BLUEBUNCH WHEATGRASS,

Cast African Agriculture and Forestry Research Organization, Nairobi (Kenya). M. S. Ndawula-Senyimba, V. C. Brink, and A. McLean.

J Range Manage. 24 (3): 198-200. Illus. 1971. Identifiers: Ability, Agropyron-Spicatum-M, Bluebunch, Canopy, Competitive, Factor, \*Grass-M, Grazing, Interception, Moisture, Size, Wheat.

Aerial parts of the caespitose type of bluebunch wheatgrass (Agropyron spicatum) were shown to direct rainwater and to concentrate it in the soil im-mediately beneath individual plants. The degree to which water collects beneath the bunches appeared to be related to the size of the canopy. It is possible that the rapid decline of bluebunch wheatgrass under heavy grazing is related to soil moisture redistribution caused by the removal of its aerial parts.—Copyright 1971, Biological Abstracts, Inc. W72-02796

COMPARISON OF VARIOUS ROTATIONS ON SILTY, POORLY-STRUCTURED SOIL: THE IMPROVING EFFECT OF GROWING FORAGE

IMPROVING EFFECT (CROPS, (IN FRENCH), Institut National de la Recherche Agronomique, Toulouse (France). Station d'Agronomie et d'Oenologie.

J. R. Marty, and S. Fioramonti.

### Group 21-Water in Plants

Ann Agron (Paris). 21 (3): 269-286. Illus. 1970.

(English summary).
Identifiers: \*Crops, Fescue-M, \*Forage, Grass-M,
Growing, Irrigation, Maize-M, Rotations, Rye, Silty, Soil, Sorghum-M, Structured, Wheat-M, Yield.

Five different rotations, with and without irrigation, were compared: cereal rotations (continuo maize, maize-wheat, maize-wheat-sorghum); rotamatze, matze-wheat, matze-wheat-sorghum); rotations of fodder crops or with introduction of pasture (fescue for 3 yr; followed by cereals, ryegrass-maize-wheat). During the 4th yr, a test crop of barley was sown in all the plots. These soils have a low potential yield under dry cultivation. Irrigation improves yield but the soil is limiting. Pasture improved yields best.—Copyright 1971, Biological Abstracts, Inc. W72-02797

RESULTS FROM TRIALS WITH CROP ROTA-TION UNITS IN THE CONDITIONS OF A CAR-BONATE CHERNOZEM, (IN BULGARIAN), Bulgarian Academy of Sciences, Sofia. Inst. of Soil

D. Dzhoumalieva, and G. Borissov.

Rastenievod Nauki. 7 (8): 51-62. Illus. 1970. En-

glish summary.
Identifiers: Barley-M, Beet-D, \*Carbonate, Chernozem, Crop, Irrigation, Maize-M, Protein, Rotation, Sugar, Trials, Units, Wheat-M.

The influence of various crop rotation units on productivity of field crops and soil fertility was studied in the course of one rotation (1964-1967) with and without double cropping under irrigation and with dry farming. Without irrigation, double cropping is unjustified. With irrigation, double cropping in the crop rotation units, coupled with correct fertilizing, considerably enhances (up to 20%) the total production of the units in terms of feed units per 0.10 ha. The best rotations were wheat plus maize as a 2nd crop; sugar beet; barley plus maize as 2nd crop; maize. Double cropping is the crop rotation units decreased the protein content in wheat and maize seed and the quantity of sugar and dry matter in sugar beet.--Copyright 1971, Biological Abstracts, Inc. W72-02798

INFLUENCE OF SALINITY ON GERMINA-TION, VEGETATIVE GROWTH, AND GRAIN YIELD OF RICE (ORYZA SATIVA VAR. DU-

Indian Inst. of Tech., Kharagpur. R. P. Narale, T. K. Subramanyam, and R. K. Mukheriee

Agron J. 61 (3): 341-344. Illus. 1969. Identifiers: \*Conductivity, Cultivar, Dunlar, Electrical, Germination, Grain, Growth, Oryza-Sativa-M, \*Rice-M, Salinity, Vegetative, Yield

An experiment in Petri dishes with filter paper beds using saline solutions of different electrical conductivities (ECe)3 obtained by dissolving common salt in distilled water to study their influence on rice seed germination, and a soil culture experiment with different levels of induced salinity under greenhouse conditions to study the effect of salinity on vegetative growth and grain yield of rice, were carried out. Rice seeds could germinate normally in medium of ECe up to 4.5 mmho/cm. Seed germination, which began to be adversely affected from ECe of 8.9 mmho/cm onwards, could, however, be initiated to some extent by transferring the treated seeds to distilled water. Grain yield and vegetative growth were markedly hampered at ECe of 7.2 and 9.8 mmho/cm, respectively.--Copyright 1971, Biological Abstracts, Inc. W72-02799

MOLINATE AND WATER MANAGEMENT FOR WEED CONTROL IN RICE, Agricultural Research Service, Stuttgart, Ark.

Crops Research Div. Roy J. Smith, Jr. Weed Sci. 19 (3): 196-199. 1971. Identifiers: Barnyard, Brachiaria-Platyphylla-M, Broadleaf, Control, Echinochloa-Crus-Galli-M, Grass-M, Management, Molinate, Oryza-Sativa-M, \*Rice-M, Signal, Time, Water, \*Weed, Yield.

The herbicide S-ethyl hexahydro-1H-azepine-1carbothioate (molinate) at 0, 3, and 6 lb/A was applied to drill-seeded rice (Oryza sativa L.) into the irrigation water at 8, 13, and 20 days after rice and weed emergence; the plots remained flooded for 2, 7, or 12 days. Three lb/A applied when weeds had 1 to 6 leaves and rice had 2 to 8 leaves controlled barnyardgrass (Echinochloa crus-galli (L.) Beauv.) and broadleaf signalgrass (Brachiaria platyphylla (Griseb.) Nash) and did not injure rice when the water remained for 7 or 12 days. Weed control and yield of rice were reduced when the irrigation water was held for only 2 days. When the weeds were tillering, molinate controlled barnyardgrass better than it controlled broadleaf signalgrass. Molinate at 0, 3, and 6 lb/A was applied to drillseeded rice into the irrigation water 1 week after rice and weed emergence; 7 days later the water was either left on the plots or was drained for 5, 10, 20, or 29 days. Three lb/A usually prevented reinfestations of barnyardgrass when plots were drained for 5, 10, or 20 days. Barnyardgrass reinrested rice drained for 29 days and reduced yields.--Copyright 1971, Biological Abstracts, Inc. W72-02800

EFFECT OF RAINFALL ON YIELD OF GROUNDNUTS IN FUIL

Rothamsted Experimental Station, Harpenden (England). I. C. R. Holford.

Trop Agr. 48 (2): 171-175. Illus. 1971. Identifiers: Fiji, Groundnuts-D, Moisture, \*Rain-

The crop was sown at monthly intervals from Nov. 1962 to Oct. 1963. Yields were closely related to rainfall occurring during specific stages of the growth cycle. Growth was most responsive to readi-ly available moisture during the establishment, rapid vegetative growth, and flowering phases up to the time of maximum flowering midway through the growth cycle. Rainfall received during the 1st half of the growing season accounted for 82% of the yield variability in the experiment, but there was not relationship between yield and rainfall during the 2nd half of the growing period.—Copyright 1971, Biological Abstracts, Inc. W72-02801

THE USE OF PLANT INDICATORS IN GROUND WATER SURVEYS, GEOLOGIC MAPPING, AND MINERAL PROSPECTING, Helen L. Cannon.

Taxon. 20 (2/3): 227-256. Illus. Maps. 1971. Identifiers: Distribution, Geologic, Ground, Indicators, Mapping, Mineral, Plant, Prospecting, Species, Type, Vegetation.

The use of vegetation in interpreting geological phenomena is becoming an important tool in the search for ore deposits that are buried under thick soil cover or layers of unmineralized rock. Species assemblages and plant density are useful in mapping geologic strata of different chemical composition and reservoir capacity. Hidden ore deposits can be located through chemical analysis of plant tissue, by mapping the distribution of spe-cies, and by observing toxic effects caused by an excess of metals as well as signs of faulty nutrition or deranged metabolism in plants whose roots are in contact with ore. Plant indicators of ore deposits may be species that are adapted to living exclusively on rocks or soils that supply unusual amounts of a particular element, or they may be species of wide distribution that favor mineralized ground under certain local conditions because of a change under certain local condutions because of a change in acidity or availability of major plant constituents. Plants that are not highly tolerant of metals in an ore assemblage may exhibit toxicity symptoms obe completely absent over ore. Geobotanical techniques of mapping indicator plant species and

combined with observation changes in plant appearance can aid the geologist in prospecting for hidden ore deposits.—Copyright 1971, Biological Abstracts, Inc. W72-02895

OSMOTIC CHARACTERISTICS OF TISSUE FLUIDS IN THE SAHUARO GIANT CACTUS (CEREUS GIGANTEUS),

Evergreen State Coll., Olympia, Wash. Oscar H. Soule, and Charles H. Lowe. Ann Mo Bot Gard, 57 (3): 265-351, Illus, 1970. Ann Mo Bot Jard. 37(3): 263-331. Inus. 1970. Identifiers: Cactus-D, Cereus-Giganteus-D, Ecological, Fluids, Giant, Osmotic, Precipitation, Range, Sahuaro, Temperature, Tissue.

Osmotic pressure of sahuaro cortex tissue fluids changed significantly during the fall and winter of changed significantly during the tail and wither 1966-67 through the range of Cereus giganteus. At the northern end of the geographic distribution, the osmotic concentration decreased significantly from 320 mOsm in Sept. to 185 mOsm in Jan. At the southern geographic limit, southern Sonora, the concentration increased significantly from osmotic concentration increased significantly from 190 mOsm in Sept. to 350 mOsm in February. In southern Arizona the osmotic concentration also increased significantly from 190 mOsm to 320 mOsm over the same period. In southern Arizona, osmotic pressure of cortex fluids decreased with increasing elevation. A significant difference in the osmotic pressure of the fluids on the south side (higher) and north side (lower) of sahuaros in all populations with increasing osmotic concentration was found. This difference did not exist when the sahuaros were in an advanced state of hydration. Indications of genetically fixed hardiness factors exist within the sahuaro populations; however, more thorough examination was beyond the sensitivity of monitoring the osmotic pressure. Changes in osmotic pressure of sahuaro cortex tissue fluids were related to effective precipitation and influenced by environmental temperatures. Within the ecological range of the sahuaro, conditions involving close interaction of low temperature and high precipitation become limiting to the distribution of this species.--Copyright 1971, Biological Abstracts, Inc W72-02896

THE DEGREE OF WATER RETAINING STRENGTH AND THE CAPACITY OF RESTORING HYDRATION IN ISOLATED LEAVES OF WOODY PLANTS, Skoplje Univ. (Yugoslavia). Faculty of Natural Sciences and Mathematics.

L. Grunche.

God Zb Annu Biol. 21. 141-152. Illus. 1969. Identifiers: Adaption, Arid, Capacity, Celtis-Australis-D, Climate, Degree, Hydration, Isolated, Leaves, Plants, Restoring, Retaining, Robinia-Pseudoacacia-D, Strength.

The water retention capacity and its increases following drying for 2, 4, 6 and 8 hr were studied in isolated leaves of Robinia pseudoacacia and Celtis australis. Robinia increases the water deficit, as austraits. Robinia increases the water deficit, as well as the osmotic pressure after 6 hr of dryness; after this period the values decrease. In Celtis the absorption capacity, water deficit and osmotic pressure constantly increase with the duration of dryness. After 8 hr of dryness, the maximal water content does not decrease to less than 42% in both types of leaves. At the same time the water deficit in Robinia reaches 35% and in Celtis, 40%. The maximal level of osmotic pressure is 27.39 at-mospheres in Robinia and 36.95 atmospheres in Celtis. The soil water strength in both species increases irregularly with a decrease in the water content of the leaves. After 8 hr of drying 32.10 atmospheres were observed in Robinia leaves and 38.01 atmospheres in Celtis. The significant preponderance of the absorbability strength over the osmotic pressure is related to the phenomenon of osmotte pressure is related to the phenomenon or negative turgor pressure which is especially evident after 4 hr of drying. The ability of Robinia and Cel-tis to increase their water retaining strength is a sig-nificant factor in their growth in arid climates..-Copyright 1971, Biological Abstracts, Inc.

W72-02897

STUDIES IN SALT MARSH ECOLOGY WITH SPECIAL REFERENCE TO THE GENUS LIMONIUM, Nature Conservancy, Norwich (England). Coastal Ecology Research Station. For primary bibliographic entry see Field 02L. W72-02902

COMMUNITY REGULATION IN PHRAGMITES COMMUNIS TRIN.: I. MONODOMINANT STANDS

Cambridge Univ. (England). Botany School.

J Ecol. 59 (1): 65-73. 1971.

Identifiers: Burning, Community, Density, Domi-nant, Grazing, Growth, Litter, Mono, Nutrients, Phragmites-Communis-M, Regime, Regulation, Salinity, Stands, Temperature.

Monodominant stands of Phragmites communis Trin. are common in Lake edges, marshes, etc. throughout the British Isles. They persist, effectively resisting invasion, for long periods. Performance, as estimated by density and height, varies with internal (e.g. biotope) and external factors. Environ-mental features affecting density are litter, water regime, nutrient status, aeration, burning, grazing, salinity and temperature (weather). Those affecting height through bud size include water regime, nutrient status, grazing, salinity and great increases in density, and those affecting growth rate include temperature, water regime, nutrient status, humidity and salinity .-- Copyright 1971, Biological Abstracts, Inc. W72-02903

THE WATER RELATIONS OF HEALTH PLANTS FROM OPEN AND SHADED HABITATS, Stirling Univ. (Scotland). Dept. of Biology.

Peter Bannister.

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J Ecol. 59 (1): 51-64. Illus. 1971. Identifiers: Calluna-Vulgaris-D, Closure, Deficit, Erica-Cinera-D, Habitats, Health, Open, Plants, Potential, Relations, Shaded, Stomatal, Vaccinium-Myrtillus-D.

The water relations of Erica cinerea, Calluna vulgaris and Vaccinium myrtillus were examined in material collected from the field. The transpiration decline of cut shoots, the relationship between water deficit and water potential and the recovery from artificially induced deficits were all measured. In general the shade plants were found to be more sensitive to water stress than plants from the more open sites in that stomatal closure occurred more rapidly and, in response to a higher water potential, deficits were more readily induced, while the damage caused by high water deficits was greater and the recovery from these deficits was poorer. The differences between sun and shade plants were least marked in Vaccinium, a species that shows a wider distribution in shade than either Erica or Calluna. Shade plants of all 3 spp. appear to retain their increased sensitivity to drought throughout the year. Large water deficits can be induced in Calluna in both summer and winter, Erica would appear to be more susceptible to winter drought while the leafless stems of Vaccinium are most resistant to desiccation. In summer, water deficits sufficient to cause stomatal closure might inhibit the intake of CO2 and result in a decreased performance of the affected plants. Such an effect is likely to be most felt in Calluna and Erica which show stomatal closure in response to the least change in water potential. The different distributions of the 3 spp. between open and shaded sites may therefore be partly explained by differences in their water relations .-- Copyright 1971, Biological Abstracts, Inc. W72-02904

SOIL MOISTURE AND STAND DENSITY AF-FECT OLEORESIN EXUDATION FLOW IN A LOBLOLLY PINE PLANTATION, Forest Science Lab., Corvallis, Oreg. Forest Insects

Ecology. Richard R. Masan.

Forest Sci. 17 (2): 170-177. Illus. 1971. Identifiers: Bark, Beetle, Density, Exudation, Flow, Ips, Loblolly, Moisture, Oleo, Pine-G, Pinus-Taeda-G, Plantation, Resin, Resistance, Soil,

Oleoresin exudation flow (OEF) is a useful expression of resin production in the study of tree resistance to bark beetles. In a 12-yr-old plantation of loblolly pine (Pinus taeda L.), changes in soil moisture availability accounted for 34% of the moisture availability accounted for 34% of the summer fluctuations in mean OEF; however, simulated soil drought alone did not significantly affect the mean OEF of a small sample of trees. Mean flow rates were reduced more by over-stocking in the stand than by temporary soil moisture stress. Unthinned parts of the stand had a much larger proportion of trees in the lowest OEF class than did e thinned plantation .-- Copyright 1971, Biological

COMPARISON OF FIELD TECHNIQUES FOR MEASURING MOISTURE STRESS IN LARGE LOBLOLLY PINES,

Forest Insects Research Project, Pineville, La. John D. Hodges, and Peter L. Lorio, Jr. Forest Sci. 17 (2): 220-223. Illus. 1971. Identifiers: Exudation, Field, Flow, Loblolly, Measuring, Moisture, Oleoresin, Pines-G, Pinus-Taeda-G, Potential, Pressure, Stress, Techniques.

In lobolly pine (Pinus taeda L.) oleoresin exudation pressure (OEP) was highly correlated with relative water content (RWC) of needles and water potenwater content (RWC) of needles and water poten-tial (WP) of twigs as measured by the pressure-chamber technique. Oleoresin exudation flow was correlated poorly with RWC and WP and not at all with OEP. The manometric technique of measuring OEP is a convenient and inexpensive way to esti-mate water stress in large loblolly pines.—Copyright 1971, Biological Abstracts, Inc. W72-02912

INSTALLATION OF NEW BIOTOPES IN THE RIVER BED OF DURANCE (SOUTHERN

FRANCE), Aix-Marseille Univ. (France). Faculte des

A. Archiloque, L. Borel, and J. P. Devaux. Ann Fac Sci Marseille. 42: 21-34. Illus. 1969. Identifiers: Animals, Bed, Biotopes, Conservation, Dams, Durance, Forest, France, Granulometry, In-stallation, Marsh, New, Plants, River, Southern.

Since the installation of a system of dams, the water supply in the lower Durance area has been stabilized, permitting a considerable progression of ized, permitting a considerable progression of forest along the river, on the sand and pebble of the old river bed, and resulting in the appearance of new groups of marsh plants. The principal ecologic requirements of the plant populations studied are brought out by the analysis of such factors as granulometry, organic carbon and pH. The new balance created brings with it new plant and animal life along the river, but this still depends on man, who can rapidly destroy the new environment. A plea is made to conserve the ecology in the cultural interest of youth.—Copyright 1971, Biological Abstracts, Inc. W72-02915

A POLYCHAETE, MANAYUNKIA SPECIOSA, FROM THE OTTAWA RIVER, AND ITS NORTH AMERICAN DISTRIBUTION, Ottawa Univ. (Ontario). Dept. of Biology. G. L. Mackie, and S. U. Oadri.

Can J Zool. 49 (5): 780-782. Map. 1971. Identifiers: American, Canada, Distribution, Manayunkia-Speciosa, North, Ottawa, Pollution, Polychaete, River.

Several specimens of a polychaete worm, M. speciosa Leidy, were found during a limnological survey of the Ottawa River (Ottawa, Canada). The survey of the Ottawa River (Ottawa, Canada). The specimens occurred only in substrates composed of silt and sand and in moderately moving waters. They were not found in the polluted areas of the Ottawa River. An up-dated record of the species in North America, from 1858 to the present, is also given.—Copyright 1971, Biological Abstracts, Inc. W72-02918

CONTRIBUTION TO THE STUDY OF PLECOP-TERA LARVAE IN MACEDONIA, Skoplje Univ. (Yugoslavia). Faculty of Sciences; and Skoplje Univ. (Yugoslavia). Inst. of Zoology. Petar Ikonomov.

God Zb Annu Biol. 21. 5-29. Maps. 1969 (Fr

Identifiers: Altitude, Distributi Macedonia, Plecoptera, Yugoslavia. Distribution, Larvae,

Larvae identifications of Plecoptera found in the territorial waters of Macedonia in the Vardar region are given. Of the 29 larvae taxa identified 21 or 72.4% are found in Central and Northern Europe, while 8 or 27.6% are limited to the Mediterranean. The horizontal and attitudinal distribution of the larvae is depicted on maps. The presence of Chloroperla appicalis, known as a river form was noted exclusively in the waters of the highest Alpine attitudes. The presence of larvae of Dictionary and appical property of the presence of larvae of Dictionary and prints. Princepage of the property of the prints of the property of the prints of the pri tyogenus alpinus, Dinocras cephalotes, Perlodes intricata and Leuctra inermis in the streams and rivers of high and medium altitudes in the Vardar Valley is probably due to the conformity of the majority of the physiographical factors in the Var-dar's middle course (southern Yugoslavia) with the same stream and river factors in the high and medi-um altitudes of Europe.—Copyright 1971, Biological Abstracts, Inc. W72-02921

OBSERVATIONS ON SOME TRICHOCERCA SPECIES (ROTIFERS) AND THEIR FOOD PREFERENCES, Centre National de la Recherche Scientifique, Fif-

ur-Yvette (France). Centre de Recherches Hydrobiologiques.

Ann Hydrobiol. 1 (2): 155-171. Illus. 1970 (Engl

Identifiers: Algae, Closterium, Food, Preferences, Rotifers, Species, Trichocerca.

The food preferences of 7 Trichocerca spp. from periphyton are studied in laboratory experiments and observations in situ. Six of these species (T. elongata, T. harveyensis, T. weberi, T. insignis, T. longiseta and T. rattus) feed on filamentous algae iongiseta and 1. rattus) feed on Hamentous aigae and 1 sucks out the content of desmids belonging to Closterium. The food ranges and the suitability of the algal species vary with the Trichocerca species. The rates of population increase are established for 4 spp. The description of unknown resting eggs is given and remarks on planktonic Trichocerca species are added. The acalesiant implication of feed cies are added. The ecological implication of food preferences is discussed.—Copyright 1971, Biological Abstracts, Inc. W72-02923

## 2.I. Erosion and Sedimentation

NOTES ON TIDAL INLETS ON SANDY SHORES, California Univ., Berkeley. Hydraulic Engineering

Lab. For primary bibliographic entry see Field 08B. W72-02261

BEACH AND NEARSHORE DYNAMICS IN EASTERN LAKE MICHIGAN,

Western Michigan Univ., Kalamazoo. For primary bibliographic entry see Field 02H. W72-02268

## Group 2J—Erosion and Sedimentation

COUR OF SIMULATED GULF COAST SAND BEACHES DUE TO WAVE ACTION IN FRONT OF SEA WALLS AND DUNE BARRIERS, Cream A and M Univ., College Station. Coastal and Ocean Engineering Div.
C. B. Chesnutt, and R. E. Schiller, Jr.

Texas A and M University Sea Grant Publication No TAMU-SG-71-207 (C.O.E. Report No 139), May 1971. 54 p, 15 fig, 3 tab, 9 ref, append.

Descriptors: \*Scour, \*Beaches, \*Sea walls, \*Gulf of Mexico, \*Texas, Model studies, Laboratory tests, Erosion, Analytical techniques, Sands, Waves (Water), Currents (Water), Berms.

Model studies of scour in front of sea walls and dune barriers were made from conditions simulating Texas Gulf Coast beaches. Texas beach sand was used in conducting the experiments. Three beach slopes, 1:40, 1:70 and 1:100, typical of Texas beaches, were studied. Sea walls with inclinations of 15 deg, 30 deg and 90 deg from the horizontal were inserted in each of the three slopes for one wave condition and in the 1:40 slope for three additional wave conditions. The ultimate scour depth just in front of the wall decreased as the be slope flattened and as the angle of inclination of the sea wall decreased. As wave height increased, the scour depth increased. Studies were also conducted on beach formations without a sea wall. Waves acting on a laboratory beach with a slope of 1:40 built a berm or dune barrier with a slope of 10 deg to 15 deg. Tests of scour in front of these dune barriers show that the ultimate scour depth is approximately equal to the deep water wave height. (Woodard-USGS) W72-02279

RECENT GLACIAL HISTORY OF AN ALPINE AREA IN THE COLORADO FRONT RANGE, U.S.A.: II. DATING THE GLACIAL DEPOSITS, Colorado Univ., Boulder, Inst. of Arctic and Alpine Research.

For primary bibliographic entry see Field 02C. W72-02286

THE FORMATION AND SHAPE OF DRUMLINS AND THEIR DISTRIBUTION AND ORIENTA-TION IN DRUMLIN FIELDS.

University Coll., London (England). For primary bibliographic entry see Field 02C. W72-02290

THE LOESS OF THE CAEN REGION (LES LOESS DE LA CAMPAGNE DE CAEN), 10J.P. COUTARD.

Centre National de la Recherche Scientifique, Caen (France). Centre de Geomorphologie. J. P. Coutard, M. Hellium, J. P. Lautridow, J. C. Ozouf, and J. Pellerin.

Centre de Geomorphologie Bulletin No 8, Centre National de la Recherche Scientifique, November 1970. 30 p, 16 fig, 1 tab, 16 ref.

Descriptors: \*Sedimentology, \*Loess, \*Sediments, \*Foreign research, Alluvium, Silts, Geology, Ero-sion, Weathering, Sediment transport, Clays, Geomorphology, Lithification. Identifiers: \*France, \*Plain of Caen (France).

Examination of the sediment of the Plain of Caen in France has revealed the existence of three Wurmian calcareous loess cycles. Between the first and second cycles there is a considerable period of weathering. The division between the second and third cycles corresponds to the Kesselt level: decarbonization, erosion, and frost-fissures. On the southwestern edge of the Plain of Caen, the latest calcareous loess (third cycle) grades laterally into a non-calcareous layered clay, a "snow-wind" characteristic of many loess beds in Normandy. The origins of this facies seems to be connected with a severe maritime influence which is fairly marked in Upper Normandy, the Cotentin peninsula, and the region of Avranches. (Woodard-USGS) W72-02297

BIOGEOCHEMISTRY OF DELTA-MENDOTA CANAL, CENTRAL VALLEY PROJECT, CALIFORNIA, Minnesota Univ., Minneapolis. Dept. of Geology

and Geophysics.
F. M. Swain, and N. P. Prokopovich.

Available from Sup Doc, GPO, Washington, D.C. 20402, \$0.50. Bureau of Reclamation Research Report No 20, 1969. 42 p. 25 fig. 13 tab, 39 ref. Bur Reclaim Contract 14-06-200-2596A.

Descriptors: \*Sediments, \*Canal linings, \*Dewatering, \*Biochemistry, \*California, Bottom sediments, Water quality, Canals, Benthos, Organic matter, Amphipoda, Benthic fauna, Benthic flora, Biota, Chemical analysis, Amino acids, Carbohydrates, Lipids, Algae, Carbon, Hydrogen, Nitragen, Nitrogen. Identifiers: \*Delta-Mendota Canal (Calif).

Numerous deposits of unusual clam-bearing sediments and an extremely abundant benthos of am-phipods and fresh-water sponges on the canal lining were observed during each of several dewaterings of the Delta-Mendota Canal in California. A biogeochemical study of sediments and some or-ganisms from the canal showed a relationship of organic materials to nutritive condition of the water, pH, Eh, and oxygen content. The canal waters are well aerated (10-13 mg/liter). The invert (canalbottom) sediments are generally poorly aerated (1-7 mg/liter), have negative oxidation-reduction potentials, and show reducing conditions. Small amounts of saturated and aromatic hydrocarbons occur in benzene-methanol extracts of sediments occur in benzene-inctination extracts of sediments and organisms. Relatively large amounts of chlorophyll-derived pigments throughout canal sediments indicate good preservative conditions for organic matter. Carbohydrates are low throughout the canal. Protein amino acids and organic acids are plentifully entrapped in the sediments and represent a large nutritive source that tends to be lost by decay in the canal rather than to be transferred to irrigation waters. Benthonic biomasses as well as sediment masses of the canal decrease stream. (Woodard-USGS) W72-02298

TRANSFORMATION OF SEDIMENT LOAD UNDER INFLUENCE OF RESERVOIRS (PREOBRAZOVANIYA TVERDOGO STOKA POD VLIYANIYEM VODOKHRANILISHCH), 10M.I., L'VOVICH, AND Akademiya Nauk SSSR, Moscow. Institut

Geografii.

For primary bibliographic entry see Field 04A. W72-02310

NATURAL SILTING OF RIVER CHANNELS AND ITS EFFECT ON YIELD OF INFILTRA-TION GALLERIES (YESTESTVENNAYA ZAILENNOST' RECHNYKH RUSEL I YEYE VLIVANIYA NA DEBITY INFILTRATSION-NYKH VODOZABOROV), V. Ye. Sergutin, A. Ye. Cherkasov, and B. F.

Turutin.

Meteorologiya i Gidrologiya, No 4, p 72-78, April 1971. 3 fig, 12 ref.

Descriptors: \*Sedimentation, \*Silting, \*Infiltra-tion, \*Channels, \*Water yield, Alluvium, Sediment discharge, Suspended load, Hyrogeology, Groundwater, Water table, Transmissivity, Drawdown, Discharge (Water), Intakes. Identifiers: "USSR, "Infiltration galleries, "Collector wells, Irkutsk Oblast, Lake Baykal, Irkut River,

Mineralization, Colmatage.

The natural silting of the Irkut River channel (Lake Baykal basin) in the zone of operation of two infiltration galleries of the Irkutsk Aluminum Plant at Shelekhovo was examined. The average annual discharge of the river at Smolenshchina/in the vicinity of the galleries during the period of observation 1928-66 was 140 cu m/sec, and the average maximum discharge of the river was 1,410 cu m/sec. The maximum discharge, observed in the summer of 1942, was 2,410 cu m/sec. Groundwater mineralization in the channel alluvial deposits of the river is less than 0.50 g/liter and varies between 0.08 and 0.47 g/liter. The hardness of water is about 6 meq. To calculate flow from the river into the galleries, the coefficients of transmissibility of the galleries, the coefficients of transmissibility of channel alluvium should be determined near the shoreline, parallel to the surface wetted by low flows of 95% probability. This will permit a more accurate determination of the degree of natural silting of the river channel and of the associated auting of the river channel and of the associated lowering of the drawdown curve, which results from a sharp reduction in the rate of flow from the river into the gallery at the time of operation. (Josefson-USGS)
W72-02314

ARECONNAISSANCE OF STREAMFLOW AND FLUVIAL SEDIMENT TRANSPORT, INCLINE VILLAGE AREA, LAKE TAHOE, NEVADA, FIRST PROGRESS REPORT, 1970,

Geological Survey, Carson City, Nev. P. A. Glancy. Nevada Division of Water Resources, Water Resources Information Series Report 8, 1971. 28 p, 1 fig, 2 photo, 7 tab, 5 ref, append.

Descriptors: \*Streamflow, \*Sediment transport, \*Water yield, \*Sediment yield, \*Nevada, Hydrologic data, Data collections, Urbanization, Land development, Water resources development, Water pollution, Nutrients, Chemical analysis, Water quality.
Identifiers: \*Lake Tahoe (Nev), Urban hydrology.

Runoff during the 1970 water year from the five major streams in the Incline Village area, Lake Tahoe, Nevada, was about 17,600 acre-feet. About three-fourths of the runoff was from Incline and Third Creeks. Sediment transported to Lake Tahoe by the major streams was estimated to be about 10,000 tons, of which about three-fourths was from Incline and Third Creeks. About 85% of the sediment was delivered to the lake during the snowmelt runoff period. The annual sediment load was estimated to be about 68% sand, 20% silt, and 12% clay. Sediment transported by streams during periods of runoff from rainfall generally contained greater percentages of silt and clay than that transported in runoff from snowmelt. Estimated annual sediment yields ranged from 50 to 650 tons/sq mi from undeveloped areas, and 1,600 to 3,200 tons/sq mi from developed areas. The estimated annual yield from the developed area was about 12 times that from the undeveloped area. The highest measured concentrations of nitrogen transported by streams to the lake during periods of heavy sedi-ment transport were of organic nitrogen, and the highest phosphorous concentrations at those times were attached to or part of the sediment particles. (Woodset/LIGGS) (Woodard-USGS) W72-02329

SEDIMENT ANALYSIS OF THE BEACHES OF LAKE VANDA, WRIGHT VALLEY, Georgia Univ., Athens, Dept. of Geology.

L.M Jones, R. E. Carver, E. R. McSaveney, and T. Tickhill.

Antarctic Journal of the United States Vol 6, No 5, p 199-200, September-October 1971. 2 fig, 1 tab, 1 ref. NSF Grants GA-14427 and GA-145-73.

Descriptors: \*Sediments, \*Beaches, \*Lakes, \*An-Descriptors: "Sediments, "Beaches, "Lakes, Anatarctic, \*Particle size, Hydrologic data, Data collections, Sampling, Sedimentology, Water level fluctuations, Geomorphology, Waves (Water), Winds, Erosions, Ice. Identifiers: \*Lake Vanda (Antarctica).

Grain-size distributions of sediments collected from the beaches of Lake Vanda in Antarctica from the beaches of Lake Vanda in Antarctica ranged from greater than 4 mm to clay. Lake Vanda occupies a closed, U-shaped bedrock basin in the western portion of Wright Valley. The lake is perennially ice-covered; the ice thickness averages 4 m. During the summer a meltwater moat forms at the edges. The width of the moat varies considerably; the average width is 9 to 12 m except for

## Erosion and Sedimentation—Group 2J

the more extensive area where the Onyx River enters the lake at the eastern end. A series of beaches parallels the level of Lake Vanda, indicating flucparameters the level of Lake vanisa, indicating indi-tuations of the lake to at least 60 m above the present level. The sediment samples were collected on the north side of the lake where the beaches are best defined and on a uniform slope. (Woodward-W72-02331

SCARBOUROUGH BLUFFS-A RECESSIONAL

STUDY, Toronto Univ. (Ontario). Dept. of Civil Engineer-

ing.
S. J. G. Bird, and J. L. Armstrong.
Proceedings Thirteenth Conference on Great
Lakes Research, April 1-3, 1970, State University
College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 187-197,
1970. 3 ref, 10 fig.

Descriptors: \*Landslides, \*Mass wasting, \*Slope stability, Lake Ontario, Groundwater movement, Slope stabilization, Great Lakes. Identifiers: \*Scarborough Bluffs (Ontario), \*Toronto (Ontario), Shoreline erosion.

At the Scarborough Bluffs, east of Toronto, severe conditions of recession of the summit and erosion of the toe are a serious problem. The result is substantial removal of valuable land, virtually priceless because of its geographical location. All se erosion and recession were examined and evaluated. Groundwater was of critical importance. The average rate of recession at the summit is approxi-mately 1 ft per yr with a maximum recorded reces-sion over a 30 year period of 310 ft. The land lost at the summit amounts to approximately 1.5 acres per year. If the present groundwater seepage and soil flow continues, land fill practices will be totally ineffective and stabilization of the bluff area, subsequent reclamation of the bluff area, sub-sequent reclamation of the lost land, and future development will be not only uneconomical, but dangerous. (See also W72-01094) (Knapp-USGS) W72-02335

AND ARTIFICIAL SEDIMENT TRACER EXPERIMENTS IN LAKE ONTARIO, Canada Centre for Inland Waters. Department of Energy, Mines and Resources, Burlington (On-

tario) J. P. Coakley.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International As-sociation for Great Lakes Research, p 198-209, 1970, 8 fig. 26 ref, append.

Descriptors: \*Tracers, \*Sediment transport, \*Lake Ontario, \*Provenance, Beaches, Littoral drift, Currents (Water), Sands, Tracking techniques, Dye releases, Fluorescence, Sedimentation, Great

Identifiers: Sediment tracers.

Thin sand bodies of intermediate surface area over-lying bedrock and glacial deposits occur at intervals in the nearshore zone of western Lake Ontario between Burlington and Toronto. Natural tracers (textural and mineralogical characteristics of the sediments) and artificially fluorescent sand were used to study transport direction by an angularity and a high proportion of non-resistent minerals. The mineralogy of the sand bodies did not vary significantly from sand body to sand body. The com bination of these features suggests derivation from local sources. Sediment transport direction is related primarily to the orientation of the shoreline with respect to easterly winds. (See also W72-01094) (Knapp-USGS) W72-02336

MODELS FOR NEARSHORE SAND TRANS-

Raytheon Co., New London, Conn. Marine D. O. Cook.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International As-sociation for Great Lakes Research, p 210-216, 1970. 3 fig, 1 tab, 17 ref.

Descriptors: \*Surf, \*Beaches, \*Sediment transport, Waves (Water), Sands, Beach erosion, Ocean waves, Littoral drift, Currents (Water), Rip currents, Coasts, Great Lakes.

Three models proposed to explain the exchange of sand between the beach and offshore are reviewed. Investigations of wave-generated currents and sand motion in the offshore zone at southern California, however, cast doubt on the validity of the models Bottom water drift may occur either towards or away from shore, and sand does not undergo extensive suspension. A new model is proposed in which the principal variables are wave dimensions and wind conditions. Differences exist between the water circulation systems of high and low energy beaches. With small waves, shoreward oscillations seem to predominate at the bottom and rip currents are not well developed. Net motion of water at the sea floor may occur either towards or away from shore, largely under the influence of wind direction and wave period. During winter storms, rip cur-rents erode sand from the beach and transport it to the nearshore, where it is confined by predominant offshore oscillations. In calm summer months, long period waves generate onshore bottom water drift which replenishes the beach with sediment. While directional inequalities in wave-induced oscilla-tions are not pronounced in the nearshore zone of an oceanic beach, shoreward surges are notably dominant in lakes or wave tanks. Also, rip currents are not well developed along low energy beaches, and water may return offshore by other means. These disparities cast doubt on the applicability of sand transport models for oceanic coasts to pro-tected lacustrine shores. (See also W72-01094) (Knapp-USGS) W72-02337

FE-MN OXIDATE CRUSTS IN ONEIDA LAKE, NEW YORK,

Syracuse Univ., N. Y. Dept. of Geology. For primary bibliographic entry see Field 02K. W72-02338

PROFILE OF A STORM-WIND, WAVES AND EROSION ON THE SOUTHEASTERN SHORE OF LAKE MICHIGAN, Williams Coll., Williamstown, Mass. Dept. of

Geology. For primary bibliographic entry see Field 02H. W72-02340

A GEOMORPHIC MAP OF LAKE MICHIGAN

United States Lake Survey, Detroit, Mich. For primary bibliographic entry see Field 02H. W72-02341

LAKÉ ONTARIO NEARSHORE SEDIMENTS, WHITBY TO WELLINGTON, ONTARIO, Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland

N. A. Rukavina

N. A. Kukavina.
Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 266-273, 1970. 2 fig, 1 tab, 8 ref.

Descriptors: \*Bottom sediments, \*Lake Ontario, \*Surveys, \*Mapping, Sounding, Sampling, Frovenance, Glacial drift, Sediment transport, Deposition (Sediments), Erosion, Beach erosion,

A nearshore survey of bottom material along the north shore of Lake Ontario between Whitby and Wellington was based upon bottom samples, echo sounder records, and underwater television observations. Three bottom types were identified and delineated: (1) glacial sediment and lag deposits, 55%, (2) sand, 25%, and (3) bedrock, 20%. Glacial 55%, (2) sand, 25%, and (3) bedrock, 20%. Unavian material occupies the major portion of the zone west of Colborne. Bedrock is exposed east of Colborne. The major sand deposit occurs in the area surrounding the Presqu'ile Peninsula. Elsewhere the sand is restricted to the vicinity of creek mouths. the sand is restricted to the vicinity of creek mouths or harbor entrances. Sand is contributed to the zone by stream discharge, bluff erosion, and submarine erosion. Net transport is in an eastward direction and accumulation occurs in the vicinity of Presqu'ile. (See also W72-01094) (Knapp-USGS)

- FAST ANALYSIS OF SEDIMENT TEXTURE,

Department of Energy, Mines and Resources, Burlington (Ontario), Canada Centre for Inland

N. A. Rukavina, and G. A. Duncan.
Proceedings Thirteenth Conference on Great
Lakes Research, April 1-3, 1970, State University
College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 274-281, 1970. 4 fig, 3 tab, 8 ref.

Descriptors: \*Sediments, \*Particle size, \*Settling velocity, \*Laboratory tests, \*Analytical velocity, \*Laboratory tests, techniques, Sampling, Particle shape. Identifiers: \*Particle size analysis.

The size analysis procedure used by the Canada Centre for Inland Waters (CCIW) Sedimentology Laboratory to provide a standard size description for all incoming samples make use of pipette analyis and Emery settling tube analysis to determine the sand/silt/clay composition of a sample and the size distribution of its sand fraction. Both procedures were modified to improve their precision and to reduce the sample size and the time required for analysis. With batch processing of the samples and output of 15.20 analyses/technical samples, and output of 15-20 analyses/techni-cian/day is possible including sample preparation and computation of results. The method has several advantages in addition to its output: settling velocity forms the basis for the entire analysis, equipment cost is low, sample size can be low as 10 g, precision is of the order of 1-2%, the procedure is easily learned and, it may be used in the field as well as the laboratory. (See also W72-01094) (Knapp-USGS) W72-02343

UNDERWATER PHOTOGRAPHY IN THE GREAT LAKES - A REPORT, Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland

For primary bibliographic entry see Field 02H. W72-02344

A VIBRO CORER AND PORTABLE TRIPOD-WINCH ASSEMBLY FOR THROUGH ICE SAMPLING,

Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland

P. G. Sly, and K. Gardener.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International As-sociation for Great Lakes Research, p 297-307, 1970. 7 fig, 11 ref.

Descriptors: \*Equipment, \*Sampling, \*Bottom sediments, \*Lakes, \*Cores, Core drilling, Drilling equipment, Hoisting machinery. Identifiers: \*Coring equipment.

A simplevibro-type corer was built for obtaining gravelly sand, sand and silty sand cores, 2 m long and about 5 cm in diameter. The corer uses a standard programment but the core standard core. dard pavement-breaker (pneumatic impactor), mounted above a plastic lined steel core barrel.

## **Group 2J—Erosion and Sedimentation**

The corer can be operated to considerable depth, limited only by the operating pressure of the impactor and by the length of the return airhose. Most components are generally available on a rental ba-sis. Sediment structures and laminations appear to be well preserved, though there is evidence of some the win preserved, though the last several to display the repacking in the cores. A specially designed portable winch and frame was built in modular form, easily handled by two or three people, and is operational even in temperatures as low as 40 deg. It can be transported by skiplane, or snow/ice vehicle. It can provide lift up to a rate of about 40 m/min, a line pull of \$90 ks under source 2356 km. line pull of 590 kg under power, or 2250 kg under manual drive. There is ample lift to provide for the use of a slightly modified vibro corer, operating either through ice or even directly on an exposed or shallow water beach surface. The system has 'fumble-free' controls and can be covered with a plastic sheet to provide an operating shelter. (See also W72-01094) (Knapp-USGS) W72-02345

NEAR-SHORE SEDIMENTS IN SOUTHERN LAKE ONTARIO, THEIR DISPERSAL PATTERNS AND ECONOMIC POTENTIAL,

TERNS AND ECONOMIC POTENTIAL, Rochester Univ., N.Y. R. G. Sutton, T. L. Lewis, and D. L. Woodrow. Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International As-sociation for Great Lakes Research, p 308-318, 1970. 6 fig, 2 tab, 6 ref. NSF Sea Grants GH-23 and GH-53.

Descriptors: \*Bottom sediments, \*Lake Ontario, \*Distribution patterns, \*Construction materials, Sands, Gravels, Sand bars, Mineralogy, Surveys, Great Lakes, Sedimentation, Mineral industry.

The southern Lake Ontario near-shore consists of boulders and till (75%), bedrock (10%), and sand and gravels (15%). Potential economic sand deposits in excess of 100 million cubic yards occur at Niagara, Rochester, and along the eastern shore. Smaller deposits occur at Hamlin Beach and Mexico Bay. Elsewhere the sand forms small isolated patches. The beach sands are generally restricted to areas adjacent to stream mouths or spits and bars extending across fronts of bays and ponds where efextending across fronts of bays and ponds where effects of the prevailing easterly currents are locally reduced. The sands fine lakeward and are displaced by muds in depths over 50-ft and at offshore distances greater than two miles. The sands generally fine from west to east. The average sand is composed of quartz, feldspar, rock fragments and heavy minerals (7%). Most of the sand originated from erosion of submerged tills, till cliffs and streams. (See also W72-01094) (Knapp-USGS) W72-02346

METHOD FOR MEASURING MINERALIZA-

TION IN LAKE SEDIMENTS, Oregon State Univ., Corvallis. Dept. of Microbiology and Oceanography. For primary bibliographic entry see Field 02H. W72-02498

MINERALOGICAL STUDY OF PISUERGO BASIN RIVERS: II. SPECIAL CHARAC-TERISTICS OF THE MINERALS AND THEIR RELATIONSHIP TO THE PARENT ROCK (IN

Seccion de Minerales, Pamplona (Spain)

S. Leguey, and J. Rodriguez. An Edafol Agrobiol. 29 (3/4): 175-192. Illus. 1970. English summary.

Identifiers: Basin, Mineralogical, Minerals, Morphology, Parent, Pisuerga, Relationship, Rivers, Rock, Spain, Stability.

An investigation was conducted on the special characteristics of the most representative minerals in the sediments. Six areas were distinguished on the bases of quantitative distribution, morphologic evolution and degree of stability of the minerals.--Copyright 1971, Biological Abstracts, Inc.

W72-02513

BIOLOGY OF THE SECCHE DELLA MELORIA: III. THE SUPERFICIAL SEDI-MENTS OF THE 'SECCHE' (SHALLOWS) AND OF THE ADJACENT AREAS FROM THE MOUTH OF THE ARNO RIVER TO PUNTA FORTULLING,

Genoa Univ. (Italy). Istituto di Geologia. Giuliano Fierro-Franco Miglietta, and Giovanni Battista Piacentino.

Boll Pesca Piscicolt Idrobiol. 24 (2): 115-149. Illus. Map. 1969. French and English summaries. Identifiers: Arno, Biology, Fortullino, Italy, Mouth, Punta, River, Secche, Secche-Della-Meloria, Sedi-ments, Shallows, Superficial.

The results of a sedimentological investigation of the 'Secche della Meloria' and adjacent bottom areas were submitted. Sediments were analyzed for texture and composition regarding the bottom morphology, the bathymetry and terrigenous supply. Hydrological data was taken into consupply. Hydrogical data was taken into con-sideration. The present investigation permitted evaluation within the limits of a basic research of the sedimentation type and of the interaction between the terrigenous and organogenous sedi-ments which are characteristics of the ecosystem of the Seche. A quaternary coastal line within bathymetries of 10 and 14 m was detected.—Copyright 1971, Biological Abstracts, Inc. W72-02554

ADENOSINE TRIPHOSPHATE IN LAKE SEDI-

MENTS: I. DETERMINATION, Wisconsin Univ., Madison. Dept. of Soils. C. C. Lee, R. F. Harris, J. D. H. Williams, D. E. Armstrong, and J. K. Syers. Soil Sci Soc Amer Proc. 35 (1): 82-86. Illus. 1971. Identifiers: Aerobacter-Aerogenes, ATP, Bio, Biomass, Determination, Eutrophication, Lake, Luciferase, Luciferin, Luminescene, Method, Microbial, Sediments.

A modification of the luciferin-luciferase bioluminescence technique was developed for determining ATP in sediments. The method involves extrac-tion with cold H2SO4, clean up with a cation exchange resin and use of living Aerobacter aerogenes cells as an internal standard to correct for incomplete ATP recovery from the sediments. ATP recovery ranged from 20 to 85%, was a characteristic, reproducible property of a given sediment, but was not related consistently to any other sediment property. The detection limits of the method were about 0.05microgram ATP/g oven dry sediment but were dependent on the oven dry sediment out were dependent on the amounts of bioluminescene-inhibitory solutes present in the extract used for final ATP analysis. Precision was low at ATP levels approaching the detection limit, primarily because of the high coefficient of variation shown at low ATP concentra-tions (about 3 x 10 to the minus 10th power M for the instrumentation and luciferin-luciferase extracts used). The method should be applicable to soils as well as sediments. The ATP contents of 9 sediment samples obtained from different lakes in Wisconsin ranged from 0.34 to 9.5 microgram ATP/g sedi-ment.--Copyright 1971, Biological Abstracts, Inc. W72-02695

ADENOSINE TRIPHOSPHATE IN LAKE SEDI-MENTS: II. ORIGIN AND SIGNIFICANCE, MENTS: II. OKRIGITA AND SIGNIFICANCE, Wisconsin Univ., Madison. Dept. of Soils. C. C. Lee, R. F. Harris, J. D. H. Williams, J. K. Syers, and D. E. Armstrong. Soil Sci Soc Amer Proc. 35 (1): 86-91. Illus. 1971. Identifiers: Aerobacter-Aerogenes, ATP, Bacterial, Bio, Biomass, Count, Eutrophication, Exchange, Lake, Luminescence, Method, Microbial, Origin, Plate, Resin, \*Sediments, Sulfuric-Acid, Validity.

The origin and significance of adenosine triphosphate (ATP) in lake sediments were evaluated using the HaSO4-exchange resin, bioluminescence technique for ATP determination. The

effects of growth stage and media composition, particularly P status, on the ATP content of Aerobacter aerogenes and other bacterial species Aerosacter aerogenes and other bacterial species were characterized under well-defined growth conditions in sediment-free systems as a basis for interpreting ATP-bacterial cell relationships in the presence of sediments. ATP calculated from plate count-derived bacterial numbers using a conver-sion factor of 1 to 4 x 10 to the minus 10th power microgram ATP/cell was consistent with the ATP content of irradiation-sterilized sediment suspensions incubated with A. aerogenes or a mixed indigenous sediment microbial population, indicating that no measurable extracellular ATP accumulated in the sediments, the sediment bacteria existed in a in the sediments, the sediment bacteria existed in a relatively inactive but not P-deficient steady-state characterized by an ATP content in the 1 to  $4 \times 10$  to the minus 10th poswer microgram/cell range, and the majority of the bacteria developing in the incubated sediments were capable of growth on Na caseinate agar. Bacterial ATP calculated from plate count data constituted a minor fraction of the cate of the force of the cate of plate count data constituted a minor fraction of the total ATP of most of the natural sediment samples evaluated. The potential of using ATP as an index of the relative amounts of C,N,P, and S associated with the living as compared to the nonliving phase of the sediments is discussed.—Copyright 1971, Biological Abstracts, Inc. W72-02696

SOIL EROSION AND ITS CONTROL (IN RUS-SIAN).

Urozhai: Kiev. 1968. 148 p. Identifiers: Control, \*Erosion, Soil, Ukraine,

This is a collection of papers which thoroughly examine the methods for assessment of erosion control measures used in the Ukraine, with some data on the efficiency of different tillage methods and of certain special protective measures for erosion control.--Copyright 1971, Biological Abstracts, Inc. W72-02736

### PROTECTIVE FORESTS STANDS AND SOIL IMPROVEMENT.

Volgograd. 1968. 58 p. Identifiers: Anti, Book, \*Erosion, \*Forests, Irriga-tion, Nutrients, Protective, Soil, Stands, Strips, USSR. Water.

The properties of forest soils are examined in the Volga-Akhtuba floodplain, the Donskaya Luka (Don's bend), the Ergeni Hills, the Transvolga region and some other regions of the steppe zone of the European part of the USSR. The variations of the soil nutrients and the water regime, and the effect protective and anti-erosion forest strips and of irrigation on the hydro-physical and physicochemical soil properties are described.--Copyright 1971, Biological Abstracts, Inc. W72-02737

CONTINUING SEDIMENT INVESTIGATIONS IN INDIANA BY THE U.S. GEOLOGICAL SUR-

VEY, Geological Survey, Indianapolis, Ind.

L. E. Johnson. Geological Survey Open-file Report, 1971. 17 p, 4 fig, 4 tab, 7 ref.

Descriptors: \*Sediments, \*Sediment transport, \*Network design, \*Data collections, Indiana, Data processing, Sediment load, Particle size, Evaluation, Sampling, On-site investigations. Identifiers: \*Fluvial sediments.

The network of suspended sediment sampling stations in Indiana, the types of data collected, and the results of an analysis of the data are outlined. An evaluation of the accuracy of the results indicated that the average error of prediction would be 20% or less for sampling stations with 3 or more years of record. (Lang-USGS)

W72-02749

TAMU RESULTS FROM THE USNS KANE 1969 EXPEDITION, GULF OF MEXICO, Texas A and M Univ., College Station. Dept. of

Oceanography.
A. H. Bouma, W. R. Bryant, and D. K. Davies.
Final Report, July 1971. 139 p. Project 663. USGS
Contr. No 14-08-0001-11990.

Descriptors: \*Sedimentology, \*Structural geology, \*Gulf of Mexico, \*Core drilling, \*Data collections, Sedimentation, Sediment transport, Lithification, Petrography, Sampling, Geomorphology, Sands, Clays, Silts, Detritus, Particle size, Carbonates, Turbidity currents, Geology. Identifiers: \*Cyclic sedimentation.

This report (in seven papers) contains the results of the Texas A and M University Sedimentology in-vestigations carried out during the summer of 1969 in the Gulf of Mexico on board the USNS Elisha Kane. Core samples were collected at 50 sites and the data are summarized in the seven papers enti-tled: (1) USNS KANE Core Stations, (2) Deep Sea Sands and Silts in the Gulf of Mexico, (3) Types and Distribution of Minor Structures in USNS KANE Gulf of Mexico Cores, (4) Cyclic Sedimentation Patterns in Deep Gulf of Mexico Sediments, (5) Composite Sedimentological 4D Map of the Gulf of Mexico, (6) Coarse Fraction Constituents, and (7) Grain Size and Carbonate Data. (See also W72-02759 thru W72-02764) W72-02758

DEEP SEA SANDS AND SILTS IN THE GULF OF MEXICO,

Missouri Univ., Columbia. Dept. of Geology. D. K. Davies.

In: Tamu Results from the USNS KANE 1969 Expedition, Gulf of Mexico; Texas A and M University Department of Oceanography Final Report, p 6-36, July 1971. 13 fig, 8 tab, 13 ref. Project 663. USGS Contr. No. 14-08-0001-11990.

Descriptors: \*Sedimentology, \*Structure, \*Gulf of Mexico, \*Sands, \*Silts, Sediment transport, Mineralogy, Data collections, Sampling, Core drilling, Geology, Geomorphology, Particle size, Pleistocene epoch, Sedimentation.

Core samples show that sand and silt interbeds of the continental slope, rise, and abyssal plain of the Gulf of Mexico, are composed of either detrital or carbonate sediments of the Pleistocene Epoch. Because of the insensitivity of the detrial minerals to transport distance and environment, the sand and silt interbeds from the deeper portions of the Gulf may be related to specific source areas on the continental shelf. These source areas include the Mississippi, the Rio Grande, and the rivers of northeast Mexico. Vertical variations in mineralogy show no significant trend with increasing depth in any core, indicating that relative contributions from each source remained constant. Carbonate sands and silts of the abyssal plain were derived from the shallow waters of the Campeche Shelf. Transportation along the axis of the Campeche Canyon carried these shelf carbonates northward into deeper water areas, in some instances through the medium of turbidity currents. (See also W72-02758) (Woodard-USGS) W72-02759

TYPES AND DISTRIBUTION OF MINOR STRUCTURES IN USNS KANE GULF OF MEX-

ICO CORES, Texas A and M Univ., College Station. Dept. of Oceanography.

A. H. Bouma. In: Tamu Results from the USNS KANE 1969 Expedition, Gulf of Mexico; Texas A and M University Department of Oceanography Final Report, p 37-81. July 1971. 19 fig, 12 ref. Project 663. USGS Contract No 14-08-0001-11990.

Descriptors: \*Sedimentology, \*Structural geology, \*Gulf of Mexico, \*Core drilling, \*X-ray analysis, Sediment transport, Faults (Geology), Sedimentation, Geomorphology, Mineralogy, Sampling, Geology, Turbidity currents, Data collections. Identifiers: Turbidity current deposits.

X-ray analysis of sediment core samples taken from X-ray analysis of sediment core samples taken from the Gulf of Mexico show a decrease in accumulation rate of minor sedimentary structures after Late Pleistocene. The Mississippi Fan contains sand turbidites overlain by silt turbidity current deposits which are covered by mud. The silty mud blankets decrease in thickness moving away from the Mississippi Delta. The northwestern Gulf of Mexico reveals little information on its depositional history. The southwestern Gulf is characterized by a high degree of bioturbation and mottling leaving few degree of bioturbation and mottling leaving few primary minor structures recognizable. The canyons all contain pelagic sediments, indicating lack of active sediment transport. The intensity of bioturbation effects increases upward in the cores which indicates a descree in the cores. which indicates a decrease in accumulation rate. In addition to primary sedimentary structures and secondary of organic origin, slump phenomena and small-scale faults were observed. (See also W72-02758) (Woodard-USGS) W72-02760

CYCLIC SEDIMENTATION PATTERNS IN DEEP GULF OF MEXICO SEDIMENTS,
Texas A and M Univ., College Station. Dept. of

Oceanography. A. H. Bouma.

A. H. Bouma.

In: Tamu Results from the USNS KANE Expedition, Gulf of Mexico; Texas A and M University Department of Oceanography Final Report, p 82-97, July 1971. 6 fig. 7 ref. Project 663. USGS Contract No 14-08-0001-11990.

Descriptors: \*Sedimentology, \*Structural geology, \*Gulf of Mexico, \*Core drilling, \*X-ray analysis, Sediment transport, Sedimentation, Lithification, Petrography, Turbidity currents, Sampling, Geology, Geomorphology, Data collections. Identifiers: \*Cyclic sedimentation.

Core samples collected from the Gulf of Mexico abyssal plain and lower Mississippi Fan contain beds interpreted as turbidites. In addition to this beds interpreted as turbidites. In addition to this type of cyclic sedimentation a number of cores from the western Gulf reveal cyclicity, based on sedimentary structures and on lithology. X-ray radiographic show that these cycles may be variations of incomplete turbidite facies models. (See also W72-02758) (Woodard-USGS) W72-02761

COMPOSITE SEDIMENTOLOGICAL 4D MAP OF THE GULF OF MEXICO,
Texas A and M Univ., College Station. Dept. of

Oceanography.

W. E. Sweet, Jr., and A. H. Bouma.
In: Tamu Results from the USNS KANE 1969 Ex-

pedition, Gulf of Mexico; Texas A and M University Department of Oceanography Final Report, p 98-120, July 1971. 8 fig, 10 ref. Project 663. USGS Contract No 14-08-0001-11990.

Descriptors: \*Sedimentology, \*Structural geology, \*Gulf of Mexico, \*Core drilling, \*Data collections, Maps, Sedimentation, Lithification, Petrography, Analytical techniques, Sampling, Geomorphology, Identifiers: Sediments (4D map).

The 4D map shows the plot of 41 sediment cores that were collected in the Gulf of Mexico. The Mississippi Fan shows up distinctly as a silty pelite. East of the Fan and extending eastward to the edge of the shelf and southward to about 25 deg 30' N there is an area of clayey pelite. West of the Missis-sippi Fan, a heart-shaped area of clayey pelite straddles the continental rise and slope across the Sigsbee escarpment. The southern end of the Fan bifurcates and a narrow band of silty pelite extends westward across the continental rise just north of the abyssal plain connecting with silty pelite in the

western Gulf of Mexico. The 4D map reveals in greater detail than a two dimensional map the complexity of sediment distribution in the Gulf of Mexico. (See also W72-02758) (Woodard-USGS) W72-02762

COARSE FRACTION CONSTITUENTS,

Texas A and M Univ., College Station. Dept. of

Oceanography.

D. M. Fitzgerald, and A. H. Bouma.

In: Tamu Results from the USNS KANE 1969 Expedition, Gulf of Mexico; Texas A and M University Department of Oceanography Final Report, p 121-133, July 1971. 3 fig. 1 tab. Project 663. USGS Contract No 14-08-0001-11990.

Descriptors: \*Sedimentology, \*Structural geology, \*Gulf of Mexico, \*Core drilling, \*Data collections, Sdimentation, Lithification, Petrography, Sampling, Geomorphology, Detrius. Identifiers: \*Sediments (Coarse fraction constitutes). stituents), Foraminifera.

Samples from the upper parts of twenty-three sedi-ment cores collected from the Gulf of Mexico were examined for their coarse fraction constituents. Illustrations include the location of these cores, microscopic analyses, and the average amount present of sixteen constituents. The coarse fraction constituents are divided into three major groups ac-cording to origin: biological, authigenic and detrital. Foraminifera and foraminiferal remains are abundant throughout nearly all samples with only a few exceptions where the abundancy decreases downward in a core. Most of the other constituents are rare in occurrence. (See also W72-02758) (Woodard-USGS) W72-02763

GRAIN SIZE AND CARBONATE DATA,

M. P. Looney, P. K. Trabant, N. J. Hall, H. Stancil,

and W. R. Bryant. In: Tamu Results from the USNS KANE 1969 Expedition, Gulf of Mexico; Texas A and M Universi-ty Department of Oceanography Final Report, p 134-139, July 1971. Project 663. USGS Contract No 14-08-0001-11990.

Descriptors: \*Sedimentology, \*Structural geology, \*Gulf of Mexico, \*Core drilling, \*Particle size, Data collections, Sampling, Geomorphology, Carbonates, Sediments. Identifiers: \*Sedimentology (Grain size), Basic-

data tables.

Grain size and carbonate content are tabulated for sediment core samples collected in the Gulf of Mexico during the geological-physical oceanog-raphy cruises of the USNS KANE during the summer of 1969. All cores were sampled in Corpus Christi after the cruises were completed. The sam-ple depths were determined by the macroscopic and X-ray radiography descriptions. A small part of the sample was removed for total carbonate deter-minations using the volumetric method by Scheibler. For size analysis, the following size intervals (phi units) were determined: 4, 4-6, 6-7, 7-8, 9-10.2, and 10.2. (See also W72-02758) (Woodard-USGS) W72-02764

GROWTH OF THE VOLGA DELTA EDGE DURING REGULATION OF STREAMFLOW AT VOLGOGRAD (PRIROST KRAYA DEL'TY VOLGI ZA PERIOD ZAREGULIROVANIYA STOKA U VOLGOGRADA), V. Ya. Goremykin.

Izvestiya Vsesoyuznogo Geograficheskogo Obshchestva, Vol 102, No 2, p 166-170, March-April 1970. 3 tab, 4 ref.

Descriptors: \*Deltas, \*Sediments, \*Sediment discharge, Suspended load, Banks, Deposition (Sediments), Aggradation, Reservoir construction, Streamflow, Runoff, Regulation, Water level fluc-tuations, Currents (Water), Velocity, Depth, Aquatic plants.

#### Field 02-WATER CYCLE

#### Group 2J-Erosion and Sedimentation

Identifiers: \*USSR, \*Volga River, Volgograd, Suspended sediments

Great hydrographic and hydrologic changes have been taking place in the Volga delta and in its offshore zone since completion of the Volgograd Hydroelectric Power Station and construction of Hydroelectric Power Statuon and construction of the Volga and Volgograd reservoirs. Regular observations are being conducted by the Caspian Scien-tific Research Institute of Fisheries to study the growth of the sea edge of the delta, variations in current velocities, depths, and the overgrowing of the outlet areas of the delta and foredelta. Two the outset areas of the delta and toredelta. Iwo principal factors are responsible for the growth of the seaward edge of the Volga delta: the Volga sediments and sea level fluctuations. Following the regulation of flow at Volgograd in 1959, linear growth along the delta decreased considerably. growth along the delta decreased considerably. Average annual growth of the delta edge between 1959 and 1964 was 43.2 m as compared with an average annual growth of 181.5 m for the period 1955-58. In 1964 the average vertical land growth along the delta edge was 34.8 cm as compared with 36.6 cm for the 6-year period 1959-64. Current velocities increased considerably at a number of outlet channels of the Volga delta following the regulation of Volga flow. The growth of underwater and above-water vegetation near the outlet banks of the delta and in the offshore zone was 25-30% greater in 1964 than in 1958. (Josefson-25-30% greater in 1964 than in 1958. (Josefson-USGS) W72-02776

CALCULATING AVERAGE ANNUAL SUSPENDED-SEDIMENT DISCHARGE IN A LIMITED SERIES OF OBSERVATIONS, AS ILLUSTRATED BY UKRAINIAN AND MOLDAVIAN RIVERS (RASCHET NORMY STOKA VZVESHENNYKH NANOSOV PRI OGRANICHEN-NOM RYADE NABLYUDENIY NA PRIMERE RE K UKRAINY I MOLDAVID.

Gidrometeorologicheskii Institut, Odessa (USSR). G. I. Shyebs.

Meteorologiya i Gidrologiya, No 2, p 75-85, February 1971. 3 fig, 7 ref.

Descriptors: \*Rivers, \*Sediments, \*Sediment discharge, \*Suspended load, Suspension, Turbidi-ty, Discharge (Water), Reservoir construction. Identifiers: \*USSR, Ukraine, Moldavia, Coefficient

Methods for analyzing series of observational data on suspended-sediment discharge in addition to methods for lengthening these series of observa-tions by use of water-discharge data or by the method of analogy are given. As an example, the average annual discharge of suspended sediments and its coefficient of variation were calculated on the basis of the average annual discharge and coef-ficient of variation for a number of rivers in the Ukraine and Moldavia, including the Severskiy Donets, Sinyukha and Aydar. (Josefson-USGS)

RADIOACTIVE SEDIMENT TRACER TESTS, HOUSTON SHIP CHANNEL, HOUSTON, TEX-

Army Engineer Waterways Experiment Station. Vicksburg, Miss. Ellis D. Hart.

WES Misc-Paper-H-69-2, Mar 69, 37 p.

Descriptors: \*Inland waterways, \*Sedimentation, \*Radioisotopes, Instrumentation, Gold, \*Tracers, Hydrography, Radiation, Texas, Sediment trans-

port. Identifiers: \*Gold 198, Houston ship channel, Scintillation counters.

Radioactive sediment tracer tests were conducted in the Houston Ship Channel to determine qualitatively the sediment movement in the channel. About 5 curies of the isotope gold 198 was thoroughly mixed with sediment samples from the channel, and the activated sediment was then deposited along the bottom at two locations. The results of tracing the deposits indicated that the activated sediment moved upstream for several miles. Activity was recorded downstream for only a short distance. Very little lateral movement out of the channel was detected. W72-02830

PHYSIOGRAPHY, ECOLOGY, AND SEDI-MENTS OF TWO BERMUDA PATCH REEFS, Leeds Univ. (England). Dept. of Earth Sciences. P. Garrett, D. L. Smith, A. O. Wilson, and D.

Journal of Geology, Vol 79, No 6, p 647-668, November 1971. 21 fig, 3 tab, 40 ref.

Descriptors: \*Reefs, \*Sedimentation, Coral, Carbonate rocks, Stratigraphy, Sedimentary structures, Shallow water. Identifiers: \*Bermuda

Two patch reefs in Bermuda's north lagoon are less than 150 m wide and rise steeply from the relatively featureless lagoon floor at 18 m depth, to within 1 or 2 m of sea level. On the rough mesa-like reef tops, coral- and algae-covered knobs are inter-spersed with sediment-filled valleys and hollows. There is no pronounced zonation of the organisms or reef structures. Massive corals, principally Monof reel structures. Massive corats, principally interest annularis and Diploria strigosa, are the most important reef-framework builders. Uneven coral growth is the major factor influencing the shape of reef cavities. The walls of these cavities veneered with distinctive growths built by the skeletons of shade-loving organisms, principally en-crusting ectoprocts, coralline algae, bivalves, and foraminifera. Sediments of the reef top are generally coarse-to-very-coarse sands with good-to-moderate sorting. All the particles are derived from the skeletons of organisms dwelling on the reefs. Some reef sands are washed down the reef face to build a steep reef sediment slope, but at distances greater than 10 m from the reef, the reefderived constituents become quantitatively unimportant. On the near-reef lagoon floor, fine sedi-ments winnowed from the reef settle from suspension. (Knapp-USGS) W72-02853

FORM AND INTERNAL STRUCTURES OF RECENT ALGAL NODULES (RHODOLITES)
FROM BERMUDA,
Johns Hopkins Univ., Baltimore, Md.; and Bermu-

da Biological Station, St. George's West.
A. Bosellini, and R. N. Ginsburg.
Journal of Geology, Vol 79, No 6, p 669-682,
November 1971. 13 fig, 2 tab, 40 ref.

Descriptors: \*Bottom sediments, \*Carbonates, \*Sedimentary structures, Rhodophyta, Waves (Water), Currents (Water). Identifiers: \*Algal nodules, Rhodolites, Bermuda.

The growth forms and internal structure of living coralline algal nodules from a shallow Bermuda bay contain a sensitive record of the frequency of their movement by wave action. The growing rhodolites are pebbleto cobble-sized spheroids found at s of 1-2 m. In section, a nucleus is surrounded by a laminated shell or coralline algae with two different growth forms: laminar and columnar. In almost all the larger rhodolites the nucleus is in-variably succeeded first by laminar and then columnar structure. Growing spheroidal and ellipsoidal rhodolites with laminar structure are con-centrated in sandy channels; flattened ones with columnar structure are half buried in skeletal sand or trapped in rock-floor depressions. The spheroidal form and laminar structure indicate frequent movement, while the flattened form and columnar were moved 3 m in the sandy channels by waves generated by winds of 15 knots. Winds of 15 knots or more occur monthly throughout the year and much more frequently during the fall and winter. The relationships between form and internal structure and frequency of movement in these shallowwater rhodolites are useful for interpreting the growth conditions of other Recent rhodolites from

deeper water, as well as those of fossil rhodolites.

CARBONATE DEPOSITION IN CARLSBAD

CAVERNS, Kentucky University, Lexington, Dept. of Geology. J. Thrailkill.

Journal of Geology, Vol 79, No 6, p 683-695, November 1971. 8 fig, 2 tab, 29 ref, append.

Descriptors: \*Limestones, \*Carbonate rocks, \*Caves, \*Water chemistry, \*Chemical precipitation, Carbonates, Travertine, Karst, Mineralogy, Calcite, New Mexico. Identifiers: Carlsbad Caverns (N Mex).

Calcite, aragonite, dolomite, hydromagnesite, and huntite are being precipitated or are being formed by alteration from precursor precipitates in Carl-sbad Caverns. Vadose seepage in contact with flowstone speleothems (stalactites and similar forms) is considerably undersaturated with respect to hydromagnesite and approximately saturated with respect to the other four carbonate minerals. Only calcite and aragonite are being deposited by such water, with precipitation caused both by CO2escape and evaporation. Nodular speleothems are also abundant in Carlsbad. Water on these forms has a lower Ca-Mg ratio than that on the flowstone group, and is forming aragonite and hydromag-nesite by precipitation, and dolomite and huntite by alteration. Except for hydromagnesite precipitation, all reactions in Carlsbad go in the direction of decreasing free energy of the water-mineral system, although most of the reactions result in metastable products. (Knapp-USGS) W72-02855

DISTRIBUTION PATTERNS AND PARTICLE SIZE OF BOTTOM SEDIMENTS IN THE TSIM-LYANSK RESERVOIR (ZAKONOMERNOSTI RASPREDELENIYA SOSTAV LOMETRICHESKIY DONNYKH GRUNTOV TSIMLYANSKOGO HRANILISHEHA), Rostov-on-Don State Univ. (USSR). VODOK.

V. A. ZKlyuyeva. Akademiya Nauk SSSR Izvestiya, Seriya Geograficheskaya, No 2, p 121-125, March-April 1970. 2 fig, 3 tab, 3 ref.

Descriptors: \*Bottom sediments, \*Sedimentation, \*Sediment distribution, \*Sediment transport, \*Sediment load, Reservoir silting, Particle size, Mineralogy, Silts, Sands, Clays, Bank erosion, Abrasion, Distribution patterns. Identifiers: \*USSR, Rostov Oblast, Tsimlyansk

Investigations were conducted in 1955-56 to study the formation, particle size, and mineralogical composition of bottom sediments in the Tsimlyansk Reservoir (Rostov Oblast). The gradual silting of the upper part of the reservoir was accompanied by the movement of sediments of increasing thickness into the lower part. Owing to bank erosion and accumulation of the sediment load of the Don, the volume of the reservoir decreased, during the first 5 years of observations, by 144.5 million cu m. By 1959 two-thirds of the reservoir bottom had become covered with silt. The maximum sediment accumulation was observed in the Chir inlet at the upper part of the reservoir, where the thickness of e silt deposits varied between 10 and 20 cm. By 1966 the thickness of the deposits in two inlets of the upper part -- the Chir and Kalach -- had exceeded 40 cm. Five types of bottom sediments were identified in the reservoir: (1) sand; (2) silty sand; (3) clayey sandy silt; (4) clayey silt; and (5) silty clay. A map of the reservoir silting by sediment types is included along with tabulations of average particle size. (Josefson-USGS)

#### Chemical Processes—Group 2K

NEW DATA ON SEDIMENT FORMATION IN THE WHITE SEA IN THE LATE POSTGLA-CIAL PERIOD (NOVYYE DANNYYE OB OSAD-KOOBRAZOVANII V BELOM MORE V POZD-NEPOSLELEDNIKOVOYE VREMYA), Akademiya Nauk SSSR, Moscow. Institut Oke-

anologii. V. S. Medvedev, and Ye N. Nevesskiy. Akademiya Nauk SSSR Doklady, Vol 200, No 1, p 179-181, 1971. 3 fig, 6 ref.

Descriptors: \*Sedimentation, \*Bottom sediments, \*Sedimentary structures, Geologic time, Recent epoch, Glaciation, Ice, Melting, Cores, Varves. Identifiers: \*USSR, \*White Sea, Glaciolacustrine deposits, Glaciomarine deposits, Holocene epoch, Boreal period, Subboreal period.

Investigations were conducted in 1964-68 by the White Sea Expedition of the Institute of Oceanology of the USSR Academy of Sciences to study the formation of bottom sediments in the White Sea in the Lake Postglacial period. The structure of the sediments in the White Sea basin attests to the existence of 4 sedimentation stages for this period: (1) a glaciolacustrine stage (Allrod), apparently associated with the presence along the basin edge of one or several fresh-water lakes, formed by the melting of ice of recent glaciation; (2) a glaciomarine stage (Late Drias), associated with the presence of a huge basin covered by a shell of floating relict ice, underlain by a deposit of homogeneous muds; (3) an intermediate stage (subboreal and boreal period) as a transition to the usual marine regime of sediment accumulation; and (4) a marine stage (Middle and Lake Holocene), characterized by the development of purely marine sedimentation. The third or intermediate stage, as typical of the sedimentary process in the White Sea, was determined by the gradual destruction of masses of floating and bottom relict ice and by the extension of marine sedimentation conditions over the entire basin. (Josefson-USGS) W72-02859

FATTY ACIDS AND HYDROCARBONS IN SURTSEY SEDIMENT, Louisiana State Univ., Baton Rouge. Dept. of

Chemistry.

J. R. Sever, and P. Haug. Nature Vol 234, No 5330, p 447-450, December 24, 1971. 2 fig, 3 tab, 19 ref.

Descriptors: \*Volcanoes. \*Sediments, \*Lagoons. \*Chlorophyta, Lipids, Organic acids, Plant populations, Mud, Marine algae, Sediment-water inter-faces, Analytical techniques, Biological communi-

ties, Dominant organisms.
Identifiers: \*Iceland, Surtsey Island, Submarine eruption, Hydrocarbons.

Hydrocarbons and fatty acids were examined from the sediments of a marine lagoon on Surtsey, an island formed by a volcanic eruption in 1963 off the south coast of Iceland. The lagoon gradually dried up and by June 1970 only a brown-caked basin remained. The sediments examined consist of fine-grained, green mud with no apparent mat formation. Analytical procedures are described for identification of hydrocarbons and fatty acids. A hydrocarbon concentration of about 2 ppm was found in the Surtsey sediments. The distribution of both hydrocarbons and fatty acids indicate that correlation can be made between the primary organisms observed in the lagoon, Chlorophycophyta, and the sediment components identified. (Lang-USGS) W72-02861

A CLASSIFICATION OF CHANNEL LINKS IN

STREAM NETWORKS,
Cold Regions Research and Engineering Lab.,
Hanover, N. H. For primary bibliographic entry see Field 04A. W72-02862

PROBABILITY DISTRIBUTION OF NUMBER OF NETWORKS IN TOPOLOGICALLY RAN-DOM NETWORK PATTERNS, Northwestern Univ., Evanston, III. Dept. of

Geological Sciences.
For primary bibliographic entry see Field 04A.
W72-02874

A STUDY OF ASSOCIATED HYDROMORPHIC AND SODIC SOILS ON REDISTRIBUTED KAR-ROO SEDIMENTS, Rhodesia Dept. of Research and Specialist Ser-

vices, Salisbury.
For primary bibliographic entry see Field 02G.
W72-02943

#### 2K. Chemical Processes

CONCENTRATION OF MINOR ELEMENTS IN CALIFORNIA STREAMS, 1960-69, Geological Survey, Menlo Park, Calif., Water

Resources Div.

Geological Survey Open-file Report, 1971. 37 p, 3 tab 9 ref

Descriptors: \*Trace elements, \*Chemical analysis, \*Water analysis, \*Streams, \*California, Water chemistry, Hydrologic data, Data collections, Geochemistry, Analytical techniques, Laboratory tests, Spectroscopy.

Minor-element analyses are reported for approximately 1000 samples collected from 207 streams in California from 1960 to 1969. The analytical technique for spectrographic analysis of minor elements (Silvey and Brennan, 1962) involves reduction of water sample aliquots from 1.5 to 3.5 liters to 100 milliliters and then addition of three chelating reagents. The three reagents quantitatively precipitate the minor elements which are then filtered and ashed at 450 deg C for 24 hours. After ashing, the oxides of the minor elements are mixed with graphite and their concentrations spectrographically determined. The 17 minor elements that can be detected by emission spectroscopy at the Sacramento laboratory are listed in the order of frequency of occurrence. Minimum concentrations for quantitative detection of the minor elements are tabulated. (Woodard-USGS) W72-02253

THE RATE OF OXIDATION OF PETROLEUM PRODUCTS IN WATER WITHOUT ADDITION

OF NITROGEN, For primary bibliographic entry see Field 05B. W72-02257

ANOMALOUS AND OTHER POLYMERIC MATERIALS.

For primary bibliographic entry see Field 01 A. W72-02264 Battelle Columbus Labs., Ohio.

BIOGEOCHEMISTRY OF DELTA-MENDOTA CANAL, CENTRAL VALLEY PROJECT, CALIFORNIA, Minnesota Univ., Minneapolis. Dept. of Geology

and Geophysics.
For primary bibliographic entry see Field 02J. W72-02298

SELENIUM IN LAKE SEDIMENTS - ANALYTI-PROCEDURE AND PRELIMINARY RESULTS.

Wisconsin Univ., Madison. Water Chemistry Pro-

gram. For primary bibliographic entry see Field 02H. W72-02300

WATER, NUCLEATION. GROWTH AND PROPERTIES,
Cold Regions Research and Engineering Lab.,
Hanover, N.H. 06Anomalous Water, Nucleation,
Growth and Properties,
For primary bibliographic entry see Field 01A.
W72-02304

CHEMICAL ANALYSES OF WATER SAMPLES COLLECTED ON AMCHITKA ISLAND,

ALASKA, Geological Survey, Denver, Colo. W. A. Beetem, R. A. Young, C. L. Washington, and L. J. Schroder.

Availabile from National Technical Information Avanual (Valuma 1974) Service, Springfield, Va 22151 \$3.00 printed copy, \$0.95 microfiche. Geological Survey Report USGS-474-135 (Amchitka-29), 1971. 23 p, 1 fig, 5 tab, 4 ref. AEC Contract AT (29-2)-474.

Descriptors: \*Data collections, \*Chemical analysis, \*Laboratory tests, \*Alaska, Boreholes, Springs, Lakes, Streams, Pacific Ocean, Water chemistry, Spectrophotometry. Identifiers: Amchitka Island (Alaska), Bering Sea.

Chemical data are presented from the Amchitka Island, Alaska, study area from water samples col-lected for and analyzed by the USGS between Oct. 1965 and Nov. 1970. Objectives were to determine the natural variation in concentrations of chemical constituents for assessing possible changes in these constituents for assessing possible changes in trese concentrations due to a nuclear detonation. Analyses of test hole water samples are tabulated by increasing latitude and increasing depth of sam-pling zone. Analyses of water samples other than those from test holes are tabulated by increasing latitude and decreasing longitude of sampling points. Sample collection procedures and laborato-ry methodology are described. A map scaled about two miles per inch shows the study area and loca-tion of sample sources. A table of unique numbers and comparative names used on the island, and four tables of analyses are included. (Lang-USGS)

APPLICATION OF ANODIC-STRIPPING VOL-TAMMETRY TO THE DETERMINATION OF SOME TRACE ELEMENTS IN SEA WATER,

Naval Weapons Center, China Lake, Calif. G. C. Whitnack, and R. Sasselli.

Available from the National Technical Information Service as AD-727 313, \$3.00 in paper copy, \$0.95 in microfiche. Naval Weapons Center Technical Publication 5186, July 1971. 8 p, 2 fig, 2 tab, 12 ref. (Reprinted from Analytica Chimica Acta, Vol 47, p 267-274, 1969). ZR01101/ZR0110101.

Descriptors: \*Chemical analysis, \*Trace elements, \*Sea water, \*Analytical techniques, Water chemis-try, Heavy metals, Electrodes, Anodes, Instrumen-tation, Laboratory tests. Identifiers: Anodic-stripping voltammetry.

An anodic-stripping technique (with a 'hanging' mercury drop electrode and a fast-sweep polaro-graph) is described in the determination of several graph is described in the determination of severe in trace elements in raw sea water. The sources of error and advantages and disadvantages of the method are discussed. A comparison of results is shown for some of the trace elements in sea water by single-sweep polarography. Concentrations of copper, lead, cadmium, and zinc ranged from 1.0 to the minus 9th power to 9.0 to the minus 9th power g/ml. Cadmium concentrations were the lowest and copper the highest (Woodsea 11906). obtained by this technique and those determined lowest and copper the highest. (Woodard-USGS) W72-02333

IDENTIFICATION AND CHARACTERIZATION OF OIL POLLUTANTS IN WATER VIA SIMUL-TANEOUS GAS CHROMATOGRAPHY EM-PLOYING FLAME IONIZATION AND FLAME PHOTOMETRIC DETECTORS FOR SULFUR

AND PHOSPHORUS, Environmental Protection Agency, Chicago, Ill., Water Quality Office.

#### Field 02-WATER CYCLE

#### **Group 2K—Chemical Processes**

For primary bibliographic entry see Field 05A. W72-02334

FE-MN OXIDATE CRUSTS IN ONEIDA LAKE,

Syracuse Univ., N. Y. Dept. of Geology. W. E. Dean.

Proceedings Thirteenth Conference on Great Lakes Research, April 1-3, 1970, State University College, Buffalo, NY, Part 1: International Association for Great Lakes Research, p 217-226, 1970. 3 fig, 1 tab, 22 ref.

Descriptors: \*Manganese, \*Bottom sediments, \*Lakes, \*New York, Water chemistry, Chemical precipitation, Sedimentation, Geochemistry, Oxidation-reduction potential, Hydrogen ion concentration. Great Lakes. Identifiers: \*Oneida Lake (NY).

Saucer-shaped iron-manganese crusts occur adjacent to gravel shoal areas in Oneida Lake in central New York. The crusts usually have a crude concentric banding owing to an alternation of orange, iron-rich layers and black, iron-poor layers. Materials from both types of layers are x-ray amorphous. The Oneida Lake crusts, like most other freshwater manganese nodules, contain about the same Mn concentration as marine manganese nodules, but are usually higher in Fe and lower in trace metals than their marine equivalents. Although Fe and Mn may be precipitating directly from the lake water, it is more likely that the oxidate crusts are the result of precipitation of Fe and Mn when reduced sediment pore water comes in contact with well oxygenated bottom waters. Organisms, particularly bacteria, may play a role in the formation of the crusts, but to date no evidence of this has been found. (See also W72-01094) (Knapp-USGS) W72-02338

PROCEEDINGS WORKSHOP ON TOXIC METALS IN WATER.

North Carolina Water Resources Research Inst. Raleigh; and North Carolina State. Dept. of Natu-For primary bibliographic entry see Field 05A.
W72-02352

DETERMINATION OF LEAD IN BIOLOGICAL AND RELATED MATERIAL BY ATOMIC AB-SORPTION SPECTROPHOTOMETRY, Cincinnati Univ., Ohio. Dept. of Environmental

Health. For primary bibliographic entry see Field 05A. W72-02375

ZONAL CENTRIFUGATION -- A TOOL FOR EN-VIRONMENTAL STUDIES, Oak Ridge National Lab., Tenn. Applied Physics

For primary bibliographic entry see Field 05A. W72-02384

INFLUENCE OF SOIL PH ON SURFACE CHARGE AND WATER TRANSMISSION, Department of Agriculture, Lethbridge (Alberta). Research Station.

For primary bibliographic entry see Field 02G. W72-02556

MEASUREMENT OF THE REDUCING ABILITY OF NATURAL WATERS AND SEDIMENTS: A SIMPLE LIMNOLOGICAL METHOD,

Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.

Janos Olan. Ann Inst Biol (Tihany) Hung Acad Sci. 37: 209-222. Illus. 1970. (Russian summary). Identifiers: Ability, Limnological, Measurement, Method, Natural, Potential, Redox, Reducing,

To measure the potential reducing ability of natural waters and sediments, a simple, direct method was employed which is based on the changes in redox potential of closed systems containing natural substrate. The measuring vessel is a 250 ml graduated glass container fitted with a ground glass stopper or made of rubber into which reference and measuring electrodes are built. By discontinuing at-mospheric O2 supply, and by excluding photosynthesis because of incubation in darkness, the redox potential decreases in the measuring ves-sel containing natural substrate. Information received during measurement include time requirement for redox potential decrease, length of decrease and redox potential decrease, length of decrease and redox potential value characterizing the state of equilibrium. Some typical experiments exemplifying the applicability of the method are given.—Copyright 1971, Biological Abstracts, Inc. W72-02591

QUALITY OF UNDERGROUND WATER AND ITTS POSSIBLE UTILIZATION FOR CROP PRODUCTION IN WESTERN RAJASTHAN, Rajasthan Salinity Lab., Jodhpur (India) For primary bibliographic entry see Field 04B. W72-02621

COMPARATIVE EFFECT OF GYPSUM AND LIMESTONE ON DRAINAGE AND SALT REMOVAL FROM COASTAL ALLUVIAL SOILS OF NEW BRUNSWICK,
Department of Agriculture, Frederiction (New

Brunswick). Research Station.

Plant Soil. 34 (1): 159-164. Illus. 1971. Identifiers: Alluvial, Canada, Coastal, Compara-tive, Drainage, \*Gypsum, \*Limestone, Movement, New-Brunswick, Salt, Soils, Water.

Equipotential lines, outflow rates and the amount of Na and chloride ions removed indicated that gypsum was a superior amendment to limestone..-Copyright 1971, Biological Abstracts, Inc. W72-02725

NITRATE TRANSFORMATION IN PEAT,

Technion - Israel Inst. of Tech., Haifa Voram Avnimelech

Soil Sci. 111 (2): 113-118. Illus. 1971. Identifiers: Decomposition, Matter, \*Nitrate, Organic, Peat, Temperature, Transformation, Varia-

Nitrates are accumulated in the peat as an end product of the decomposition of organic matter. Nitrate production is effected by the moisture content of the peat, reaching an optimum at about field capacity. Its rate is roughly doubled between 24 deg and 36 deg C. The rate of nitrate accumulation at field capacity is 7 and 17 microgram NO3/g soil/day at 24 and 36 deg C, respectively. These values were used for the calculation of O2 consumption by the decomposition process. The average O2 consumption for the temperature range mentioned above is 2.28 mmole O2/kg soil/day. Such high O2 consumption favors anaerobic conditions in the subsoil layers. Under these conditions, a rapid process of denitrification occurs. The rate of the process depends on temperature, nitrate concentration and on the interaction between concentration and on the interaction between them. The reaction appears to be a 1st order one. The existence of 2 different denitrification mechanisms is indicated by the presence of 2 groups of rate constants and different changes in 1971, Biological Abstracts, Inc.
W72-02729

STUDY OF MECHANISMS CONTROLLING THE ULTRAVIOLET PHOTOCHEMISTRY OF ASSOCIATED AND POLYMERIC SYSTEMS, Stanford Research Inst., Menlo Park, Calif. For primary bibliographic entry see Field 07B. W72-02744

SOME REGULARITIES OF DISTRIBUTION OF SOME REGULARITIES OF DISTRIBUTION OF MICRO- AND MACRO-COMPONENTS IN THE OIL-FIELD WATERS OF AZERBAIDZHAN, Akademiya Nauk Azerbaidzhanskoi SSR, Baku. Inst. of Inorganic and Physical Chemistry. A. N. Nuriyev, E. I. Shik, and R. S. Abdullayeva. Geochemistry International, Vol 7, No 6, p 958-965, 1970. 4 fig, 1 tab, 12 ref. (Translated from Geokhimiya, No 11, p 1357-1364, 1970).

Descriptors: \*Geochemistry, \*Water chemistry, \*Water analysis, \*Chemical analysis, \*Groundwater, Oil fields, Trace elements, Salinity, Bicarbonates, Calcium chloride, Boron, Sea water. Identifiers: \*USSR, Azerbaidzhan, Oil-field waters, Bromine, Iodine, Statistical analysis.

Least-square equations for about 2,000 chemical analyses of the macroand micro-components in groundwaters of petroleum deposits of Azerbaidzhan were examined to establish relationships between chemical composition and salinity in bicarbonate and calcium chloride oil-field waters. Bromine and iodine contents were found to be directly proportional to salinity, while boron was inversely related to both solutes. A high boron content is typical of the bicarbonate waters; bromine and iodine are more characteristic of the calcium chloride solutions. (Josefson-USGS) W72-02774

HYDROLOGY OF BASALT AQUIFERS IN THE HERMISTON-ORDNANCE AREA, UMATILLA AND MORROW COUNTIES, OREGON.

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 02F. W72-02783

RECONNAISSANCE OF THE PERE MARQUETTE RIVER, A COLD WATER RIVER IN THE CENTRAL PART OF MICHIGAN'S SOUTHERN PENINSULA,

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 02E. W72-02784

CARBONATE DEPOSITION IN CARLSBAD

CAVERNS, Kentucky University, Lexington, Dept. of Geology. For primary bibliographic entry see Field 02J. W72-02855

FATTY ACIDS AND HYDROCARBONS IN SURTSEY SEDIMENT, Louisiana State Univ., Baton Rouge. Dept. of

Chemistry.
For primary bibliographic entry see Field 02J.
W72-02861

NOTE ON PLANT NUTRIENT IN RAIN WATER AT VARANASI, Banaras Hindu Univ., Varanasi (India).

For primary bibliographic entry see Field 02B. W72-02942

EFFECT OF WATERLOGGING ON REDOX POTENTIAL, AVAILABLE P AND PH IN SOME INDIAN ACID SOILS, Calcutta Univ. (India). Dept. of Agriculture.

For primary bibliographic entry see Field 02G. W72-02946

#### 2L. Estuaries

SALINITY DISTRIBUTION IN THE THAMES RIVER: NEW LONDON TO NORWICH, CON-Naval Underwater Systems Center, Newport, R. I.

Navai Underwater Systems Center, Newport, K. I. E. F. Soderberg, and A. B. Bruno. Available from NTIS, Springfield, Va. 22151 as AD-728 405, \$3.00 paper copy, \$0.95 microfiche. Navai Underwater Systems Center Report No

4005, April 1, 1971. 87 p, 15 fig, 3 tab, 17 ref, 4 ap-

Descriptors: \*Saline water intrusion, \*Estuaries, \*Salinity, \*Fresh water, \*Connecticut, Mixing, Tidal waters, Water quality, Water temperature, Electrical conductance, Hydrologic data, Data collections

Identifiers: \*Thames River (Conn), Salinity dis-.

Observations of temperature, electrical conductivi-ty, and salinity in the Thames River, Connecticut, made over a 12-month period, are used to describe the Thames River estuary. Longitudinal profiles of the river show the effects of upland stream discharge upon the fresh/salt structure of the river. asknarge upon the treshyata structure of the rivers The freshwater discharge into the estuary is usually small, and during most of the year the waters of the Thames River are of relatively high salinity throughout its length. During periods of high stream discharge, however, the head of the salt wedge may be pushed several kilometers downriver by the freshwater inflow to the estuary. The salinity distribution in the river is described in terms of salinity stratification as a function of distance along the length of the river, with volume of freshwater discharge as the parameter. (Woodard-USGS) W72-02278

SAND WAVES IN THE TIDAL ENTRANCE TO CHESAPEAKE BAY: PRELIMINARY OBSER-VATIONS,

Old Dominion Coll., Norfolk, Va. Inst. of Oceanog-

raphy. J. C. Ludwick.

Chesapeake Science, Vol 11, No 2, p 98-110, June 1970. 6 fig, 45 ref.

Descriptors: \*Sand waves, \*Bays, \*Tidal effects, \*Inlets (Waterways), \*Channel morphology, Shoals, Sands, Sedimentation, Sedimentary structures, Currents (Water), Sediment transport. Identifiers: \*Chesapeake Bay, \*Tidal entrance (Chesapeake Bay).

Sand waves are present on the bottom in the tidal entrance to Chesapeake Bay. As far as known they are confined largely to the northern part of the en trance in an area of sand shoals and tidal channels. The waves found are 5 to 10 feet in height and 200 to 800 feet in crest-to-crest length. They occur in water 15 to 35 feet deep and are found both atop shoals and in channels. Symmetrical and asymmetrical and a rical profile types were observed. Near the tidal current thalweg in North Channel, sand waves are largely asymmetrical and face seaward with the ebb. At greater lateral distances away from the thalweg, symmetrical forms are more common, a situation suggestive of equal ebb and flood currents. With even greater distance, sand waves are not developed, a situation suggestive of current in-competence. In a closed-end flood channel, asymmetrical sand waves face landward toward the closed end of the channel with the flood current. On one sand shoal, marginally-located sand waves face convergently toward the higher center of the shoal where symmetrical waves are found. Sand wave migration is believed to be a factor in the maintenance and evolution of some tidal shoals. (Woodard-USGS) W72-02296

SALINITY OF THE SURFACE WATERS IN THE SAINT LAWRENCE ESTUARY,

Laval Univ., Quebec. Departement de Biologie. Rene Lavoie, and Gerard Beaulieu. Natur Can. 98 (2): 191-193. Map. 1971.

Identifiers: Canada, Estuary, Salinity, St Lawrence,

Using data collected in July 1949 on the salinity of the surface waters of the St. Lawrence estuary and various maps, a salinity gradient applicable to the middle estuary and to the upstream portion of the maritime estuary was determined. The map obtained is given along with the data used in its production.--Copyright 1971, Biological Abstracts, Inc. W72-02550

OCCURRENCE OF THE QUAHOG, MERCENARIA, IN LAGOON, LONG BEACH, CALIF., Cerritos Coll., Norwalk, Calif. NORTHERN

Anthony Salchak, and Jeff Haas.
Calif Fish Game. 57 (2): 126-128. Illus. 1971.
Identifiers: California, Colorado, Lagoon, Long
Beach, Mercenaria-Mercenaria, Northern, Quahog.

The 1st specimens were collected in 1967. In 1969 a survey of Colorado Lagoon showed clams of varying sizes present. It is believed that the colony is well established.--Copyright 1971, Biological Abstracts, Inc. W72-02581

DISTRIBUTION OF JUVENILE BROWN DISTRIBUTION OF JUVENILE BROWN
SHRIMP (PENAEUS AZTECUS IVES) IN GALVESTON BAY, TEXAS, AS RELATED TO CERTAIN HYDROGRAPHIC FEATURES AND
SALINITY,
Texas A and M Univ., College Station.

Contrib Mar Sci. 15: 1-12. Illus. 1970.

Identifiers: Bay, Brown, Distribution, Emigration, Galveston, Hydrographic, Juvenile, Penaeus-Aztecus, Salinity, Shrimp, Texas.

A survey of juvenile brown shrimp, Penaeus aztecus Ives, was conducted in Galveston Bay during 1963 and 1964 to determine where they were concentrated, to establish their movement patterns, and to determine to what extent salinity effects their distribution. Upon entering the bay, these along shrimp were found concentrated primarily along the shores and in the marshes and bayous. Re-distribution did not occur until Gulfward emigration began. The path of enigration appeared to be along a direct route to the passes and not the results of a random search. Size at emigration varied between 70-100 mm. Shrimp were abundant at salinities from 0.9 to 30.8% and it was concluded that salinity per se had no detectable effect on distribution .-- Copyright 1971, Biological Abstracts, Inc. W72-02642

FOOD OF PREDATORY DEMERSAL FISH IN HAURAKI GULF: III. FEEDING RELATION-

Victoria Univ., Wellington (New Zealand). Bruce L. Godfriaux.

N Z J Mar Freshwater Res. 4 (4): 325-336. Illus. 1970.

Identifiers: Caranx-Lutescens, Chelidonichthys-Kumu, Chrysophrys-Auratus, Competition, Demersal, Feeding, Fish, Food, Gulf, Hauraki, Holorhinus-Tenuicaudatus, New Zealand, Predato-Relationships, Trachurus-Novaezelandiae, ry, Realization Zeus-Japonicus.

In 1965-66, the feeding relationships of snapper Chrysophrys auratus (Forster), trevally Caranx lu-tescens Richardson, red gurnard Chelidonichthys kumu Lesson and Garnot, horse mackerel Trachurus novaezelandiae Richardson, eagle ray Holor-hinus tenuicau-datus (Hector) and john dory Zeus japonicus Cuvier and Valenciennes were examined at 2 specific sampling areas ('combined' and Kawau stations) in inner Hauraki Gulf and more generally throughout the entire Gulf and along the northwestern edge of the Bay of Plenty. An analysis at specific sampling areas, made by calculating the indices of competitive independence, indicated that interspecific competition occurred rarely and relatively mildly. The general analysis throughout the study region, made by comparing the diet com-positions of the predatory fish species, showed that competition was again largely avoided by dif-ferences in food preferences and feeding habits. Snapper had the greatest diversity of diet and the smallest feeding overlap; these facts may explain why the relative numbers of snapper are greater than those of any other predatory demersal fish in the region.—Copyright 1971, Biological Abstracts, W72-02643

RELATIVE ABUNDANCE, SEASONAL DISTRIBUTION, AND SPECIES COMPOSITION OF DEMERSAL FISHES OFF LOUISIANA AND TEXAS, 1962-1964,

Bureau of Commercial Fisheries, Galveston, Tex. Biological Lab. Donald Moore, Harold A. Brusher, and Lee Trent. Contrib Mar Sci. 15: 45-70. Illus. 1970.

Identifiers: Abundance, Composition, Cynoscion-Arenarius, Cynoscion-Nothus, Demersal, Distribu-tion, Fishes, Galeichthys-Felis, Louisiana, Micropogon-Undulatus, Off, Seasonal, Species, Stenotomus-Cparinus, Synodus-Foetens, Texas.

Demersal fishes were collected monthly shrimp trawl at 33 to 60 stations in 7 to 110 m (4-60 fath (fathoms)) between the Mississippi River Delta and the USA-Mexico border from through 1964. Catches were generally 2-5 times greater off Louisiana than off Texas, with the greatest differences occurring in the shallowest waters. Differences in total catches between stawaters. Differences in total catches between stations within each depth off Texas and Louisiana, between day and night tows, and between years generally were not significant. Seasonal differences in catches were great off each coast. The greatest catches off Louisiana were made in the winter and summer, and those off Texas were in the summer and fall. The largest catches were made between 7 and 46 m (4-25 fath) depths off Louisiana, and 27 and 110 m (15-60 fath) depths off Texas. Atlantic croaker, Micropogon undulatus and longspine progy, Stenotormus caprimus, constituted nearly half of the total catch. Atlantic croaker, longspine porgy, sand seatrout, Cynoscian arenarius and sea cat-fish, Galeichthys felis, were most abundant off Louisiana; longspine porgy, Atlantic croaker, inshore lizardfish, Synodus foetens and silver seatrout, Cynoscion nothus, dominated the catches off Texas .-- Copyright 1971, Biological Abstracts, W72-02649

AN AERIAL PHOTOGRAPHIC TECHNIQUE FOR BEACH EROSION SURVEYS IN NORTH CAROLINA,

Army Coastal Engineering Research Center, Washington, D.C. Donald B. Stafford.

Center Technical Memorandum No. 36, October, 1971. 122 p, 62 ref.

Descriptors: \*Photogrammetry, \*Aerial photography, \*Beach erosion, \*Surveys, \*Instrumentaraphy, \*Beach erosion, \*Surveys, \*Instrumetion, \*North Carolina, Photography. Identifiers: \*Onslow county, \*Carteret county.

This study presents a procedure developed to use existing aerial photographs to survey beach ero-sion. The use of the procedure is illustrated by data from Onslow and Carteret Counties in North Carolina. A preliminary evaluation of the results obtained in these two counties is given. The procedure is applicable to a variety of conditions and has important advantages over other methods of collecting beach erosion data. The procedure consists of selecting stable reference points on aerial photographs taken in different years and measuring between the stable reference points and points on the transient beach. The measurements are converted to ground distances, and the difference in ground distance is computed. The difference in ground distance represents the change in location of the beach between the dated of the aerial photographs and is converted to an annual rate of the change by dividing by the time interval. The change in two locations on the beach, the dune line and the high water line, is determined. A special effort was made to reduce the effects of the errors inherent in aerial photographs. An extensive review of the

#### Field 02-WATER CYCLE

#### **Group 2L—Estuaries**

literature concerning the applications of aerial investigations photographs to involved. W72-02687

EXPERIMENTS IN CULTIVATING THE OYSTER CRASSOSTREA RHIZOPHORAE (GUILDING 1828) IN EASTERN VENEZUELA, Universidad de Oriente, Cumana (Venezuela). Inst. of Oceanography. Anibal Velez.

Lagena. 19/20. 11-20. Illus. 1968.

Identifiers: Crassostrea-Rhizophorae, Cultivating, Eastern, Oyster, Perna-Perna, Rhizophorae-Man-

There is virtually no oyster industry in Venezuela because the roots of the red mangrove, Rhizophorae mangle, which is the natural substrate of the oyster, is not present in sufficient abundance to maintain a good production. Furthermore, the fishermen tend to collect oysters without regard to size and, in addition, they cut the roots of the mangroves, thus destroying the little natural substrate and exterminating the oyster. In the Bay of Mochina (Venezuela) a method for growing and collecting oysters, using wood rectangles, is described. Another procedure involves tiles. The method for collecting oysters, using shells, such as is used in Japan, is best adapted to conditions in Venezuela. The shell of Perna perna is easily acquired and is large enough to offer good attachment.--Copyright 1971, Biological Abstracts,

W72-02688

RECENT CHANGES IN STRIPED BASS (MORONE SAXATILIS) SPAWNING SITES AND COMMERCIAL FISHING AREAS IN UPPER CHESAPEAKE BAY: POSSIBLE INFLUENCING FACTORS.

Maryland Univ., Solomons. Natural Resources Inst. William L. Dovel, and James R. Edmunds. Chesapeake Sci. 12 (1): 33-39. Illus. 1971.

Identifiers: \*Bass, Bay, Chesapeake, Commercial, Fishing, Morone-Saxatilis, Recent, Sites, Spawning, Striped, Upper.

Chesapeake Bay annually contributes a large per-centage of all the striped bass produced in North America. For many years, the lower Susquehanna River was considered the major spawning area in the Bay. Recent evidence suggests that the areas of greatest egg abundance, as well as commerical fishing for striped bass in the upper boy, now occur along the main navigational channel from Worton Point to Chesapeake City on the Chesapeake and Delaware Canal. This shift had apparently resulted from major environmental alterations which have occurred in the last 90 yr. The construction of the C and D Canal, at the head of Chesapeake Bay, has increased the total area suitable for species propagation and commercial fishing activities.--Copyright 1971, Biological Abstracts, Inc. W72-02716

MARINE HUMUS IN THE SAN'IN OFFSHORE

SEDIMENTS, (IN JAPANESE), Industrial Science and Technology Agency, Kawaski (Japan). Geological Survey.

Kazuo Ohshima, and Setsuya Yokota. Bull Geol Surv Jap. 21 (4): 279-286. Illus. Maps.

1970. English summary. Identifiers: Humus, Japan, Marine, Offshore, Sanin, \*Sediments, Temperature, Water.

The marine humus content is low in the Miho Bay and continental shelf (total C, 0.15 approx. 1.35%; total N, 0.004 approx. 0.63%), and high in the continental slope (total C, 2.16 approx. 3.14%; total N, 0.16 approx 0.63%). These differences may be attributed to the decompositional rate in high water temperature condition and oxidizing effects of currents and to the decomposition and total contents. rents and wave action which sweep the finely di-vided organic matter and the fine-grained sediments into the depression. The latter environment

favors the preservation of the marine humus. Absorption spectrum of humic acid extracts of sediments with sodium pyrophosphate showed several absorption bands (220 m micro and 400 m micro). The vertical distribution of marine humus is generally constant in the upper 50 cm of the core from more than 1000 m in water depth. The data are discussed with respect to the water temperature and topography of the sea during the period of sedimentation.--Copyright 1971, Biological Abstracts, W72-02730

A STUDY ON THE PRODUCTION OF SER-GESTES LUCENS IN RELATION ZOOPLANKTON IN SURUGA BAY, JAPAN, Tokyo Univ. (Japan). Ocean Research Inst. N. Omori.

J Oceanogr Soc Jap. 26 (4): 242-252. Illus. 1970.

Descriptors: \*Zooplankton.

Identifiers: Bay, Eucampia, Japan, Phyto, \*Plankton, Production, Relation, Sardines, Sergestes-Lu-

Effects of environmental factors on the development of S. lucens in Suruga Bay, Japan are discussed. Phyto and zooplanktons including Eucampia and sardines show effects on the produc-tion of S. lucens in this bay.--Copyright 1971, Biological Abstracts, Inc. W72-02743

MODEL STUDY OF GALVESTON HARBOR ENTRANCE, TEXAS. HYDRAULIC MODEL IN-VESTIGATION, Army Engineer Waterways Experiment Station,

Vicksburg, Miss. For primary bibliographic entry see Field 08B. W72-02816

PHYSIOGRAPHY, ECOLOGY, AND SEDI-MENTS OF TWO BERMUDA PATCH REEFS, Leeds Univ. (England). Dept. of Earth Sciences For primary bibliographic entry see Field 02J. W72-02853

OPTIMUM EXPLOITATION OF GROUND-WATER RESERVES WITH SALTWATER IN-TRUSION.

Resources for the Future, Inc., Washington, D.C. R. G. Cummings.

Water Resources Research, Vol 7, No 6, p 1415-1424, December 1971. 2 fig, 18 ref.

Descriptors: \*Saline water intrusion, \*Aquifers, \*Withdrawal, Water resources development, \*Optimization, Mathematical models, Systems analysis, Economics, Cost-benefit analysis. Identifiers: \*Coastal aquifers.

The optimal rate of exploitation of groundwater stocks in coastal areas with intrusion of salt water is modeled to solve the interrelated problems of the annual rate of pumping and the annual rate of investment in pumping equipment, in which the effects of current decisions on future benefits are included. These include impacts of lower stocks and therefore higher future pumping costs, and in-creased rates of saltwater intrusion. Periodic extractions are carried to the point where the value of water in current use equals the marginal present value of water in storage. The value of water in storage uncludes marginal effects of current production on intrusion, pumping costs, and capital consumption. The conjunctively determined periodic rate of investment is that which equates marginal investment costs with the present value of future production attributable to larger pumping and distribution systems, discounted by depreciation rates. (Knapp-USGS) W72-02876

STUDIES IN SALT MARSH ECOLOGY WITH SPECIAL REFERENCE TO THE GENUS LIMONIUM,

Nature Conservancy, Norwich (England). Coastal Ecology Research Station. L. A. Boorman.

J Ecol. 59 (1): 103-120. 1971.

Grazing, Great, Growth, Immersion, Ireland, Limonium-D, Limonium-Humile-D, Limonium-Vulgare-D, Marsh, Salinity, Salt, Season.

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Floristic data were collected from 230 salt marsh sites around the coast of Great Britain and Ireland. Sites around the coast of order britain an instantial these data were analyzed and compared on the basis of the presence or absence of Limonium vulgare and L. humile. The behavior of the various salt marsh species was used to compare the nature of groups of sites and to indicate the behavior of Limonium itself. The data also illustrate the nature of the salt marsh community all around the coast.

The distribution of individuals within the salt marsh community was often shown to be distinctive and was attributed to intrinsic, environmental, interspecific, or historical factors. An intensive study was made in a small area of Scolt Head Island where 4 different methods were used and the results compared. Permanent quadrats at Scolt Head Island were set up to examine the long term changes in the salt marsh community. The ratio of flowering to non-flowering shoots of L. vulgare was also observed. Transplant experiments were made with 3 spp. of Limonium. The results suggested that mature plants were more tolerant of adverse condi-tions when moved out of their normal zone, suggesting that the seedling stage was the critical one in determining the ecological amplitude of a species. The effect of water level on the growth seedlings and mature plants was also investigated. This showed that both immersion and salinity seriously affected plant growth. Studies of the sea changes in the salt marsh community showed that the interrelations of the different species varied throughout the season. The ecology of L. humile and L. vulgare was compared. It was shown that L. humile in Ireland occupied a similar niche to L. vulgare in Great Britain. Both species were plants of the middle and upper salt marsh and plants of open Where they occurred together the differences were noticeable. In eastern England L. humile was a nuch rarer plant than L. vulgare and was restricted to a narrow zone in the middle of the range of the latter.—Copyright 1971, Biological Abstracts, Inc. W72-02902

OBSERVATIONS ON NEWLY INTRODUCED LAND-LOCKED ALEWIVES (ALOSA PSEU-DOHARENGUS) IN MAINE, Colorado State Univ., Fort Collins. Dept of Fishe-

ries and Wildlife Biology. Robert T. Lackey.

N Y Fish Game J. 17 (2): 110-116. Illus. Maps. 1970

Identifiers: Alewives, Alosa-Pseudoharengus, Crustacea, Food, Insect, Landlocked, Maine, Micro, Spawning.

Three Maine lakes were stocked in 1966 with landlocked alewives taken from Cayuga Lake, New iandiocked aleuvies taken from Cayuga Lake, New York. Two lakes supported aleuvies in 1969. Spawning activity apparently took place from about mid-June to mid-August. Growth of both transplanted aleuvies and their progeny was very rapid. Aleuvies occupied the mid-to upper water in summer and fall, but descended to deeper water in winter and spring. The food of alewives was almost entirely microcrustacea, although a few insects were eaten.--Copyright 1971, Biological Abstracts, W72-02905

MARINE CULTURES: STUDIES OF ACCLI-MATATION OF THE CLAM, VENOUS MER-CENARIA, IN A MEDITERRANEAN LAGOON.

Sci Peche. 193, 1-13, Illus, Map. 1970.

#### WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

#### Saline Water Conversion—Group 3A

Identifiers: Acclimatation, Clam, Cultures, Lagoon, Marine, Mediterranean, Pollution, Preda-tors, Venus-Mercenaria, Wind.

The Etang of Thau is a salt water lagoon near Mar-seille. A pilot study was organized to determine whether these clams could be raised within this lagoon. The important factors were the wind and the characteristics of the sandy bottom. The initial project experienced difficulty in raising adult clams from young clams, in having the clam reproduce, and in protecting the experimental bed from preda-tors and pollution. These initial difficulties are not believed determinative of the future of raising clams in the lagoon.-Copyright 1971, Biological Abstracts, Inc. W72-02907

#### 03. WATER SUPPLY **AUGMENTATION** AND CONSERVATION

#### 3A. Saline Water Conversion

TURBULENCE PROMOTERS FOR HYPERFILTRATION WITH DYNAMIC MEMBRANES, Oak Ridge National Lab., Tenn.

David G. Thomas, William R. Mixon, Phil H., Hayes, and John D. Sheppard. Environmental Science and Technology, Vol 4, No. 12, December 1970, p 1129-1136, 9 fig, 1 tab,

\*Turbulence, \*Membranes. Permeability, \*Desalination, Mass transfer, Velocity, Pressure, Friction, Reynolds number, Separation techniques, \*Waste water treatment, Membrane processes, Filtration. Identifiers: Turbulence promoters, \*Flux, Hyperfil-

An ideal requirement that turbulence promoters in membrane processes neither block the membrane surface nor produce stagnant regions where solids can accumulate or the concentration of rejected salts can build up was established. Tests were then conducted to determine the effect of various promoter designs on permeability and rejection of dynamic membranes and to assess their effect on desalinated water costs. Using hydrous Zirconium oxide dynamic membranes and MgCl2 solution feeds, it was demonstrated that the spiral turbulence promoter with no runners (separated from the surface .002 to .004 in.) gave the same intrinsic rejection as the smooth upstream half of the membrane tube, while at the same time both increasing the flux and reducing the rate of flux decline. Use of turbulence promoters in an optimization procedure allowed a 35% reduction in inlet pressure, a 50% reduction in inlet velocity, and a 65% reduction in tube length over smooth tubes. Despite the reductions, these conditions resulted in a 48% flux increase and a significant economic advantage due to increased membrane permeability in the presence of turbulence promoters. (Lowry Texas) W72-02385

COMBINED WASTE WATER RECLAMATION AND SEA WATER DESALTING FACILITIES. Orange County Water District, Santa Anna, Calif. For primary bibliographic entry see Field 05D. W72-02413

ECONOMY ASPECTS OF DESALTING APPLICATION, TULAROSA BASIN OF NEW MEX-New Mexico State Univ., University Park. New

Mexico Water Resources Research Inst. For primary bibliographic entry see Field 06B. W72-02447 IMPROVEMENT OF THE DESALINATED WATER'S QUALITY INTENDED FOR DRINK-ING PURPOSES (IN RUSSIAN), For primary bibliographic entry see Field 05D. W72-02628

PUMPING AND ENERGY SYSTEMS FOR REVERSE DESALINATION PLANTS, Dynatech R/D Co., Cambridge, Mass. ENERGY RECOVERY REVERSE OSMOSIS OSMOSIS

K. E. Hickman, J. P. Tramoni, J. T. Ganley, and E.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price \$2.00. Office of Saline Water Research and Development Progress Report No. 457, August 1969, 263p, 97 fig. 33 tab, 120 ref, 3 append. OSW 14-01-0001-1462.

Descriptors: \*Desalination, \*Reverse osmosis, Desalination plants, Pumping, Energy, Desalination apparatus.
Identifiers: Energy recovery equipment.

Pumping and energy recovery equipment for reverse osmosis desalination plants were surveyed and areas were identified in which further research and development work is desired in order to improve the operating characteristics and economics of the respective systems. Factors that influence water cost were analyzed. (OSW Abstract) W72-02948

SCALE CONTROL WITH GRAPHITE HEAT TRANSFER TUBES OF CONTROLLED PERMEABILITY TO STEAM - PHASE II, Union Carbide Corp., New York. Carbon Products

L. E. Vaaler, and S. V. Desai.

Available from Supt. of Documents U.S. Government Printing Office, Washington, D.C. \$0.30. Office of Saline Water Research and Development Progress Report No. 396, October 1968. 16 p, 5 tab, 7 fig. OSW 14-01-0001-685.

Descriptors: \*Control, \*Porosity, \*Heat transfer, \*Scaling, \*Calcium sulfate, \*Desalination, Distillation, Evaporators. Identifiers: \*Falling film evaporation, \*Vertical tube evaporators.

The objective was to determine the effect of controlled porosity heat transfer tubes on the deposi tion of calcium sulfate scale under conditions that simulate the higher operating temperatures of the first effect of the VTE desalting plant in Freeport, Texas. A graphite tube heat transfer apparatus was modified for tests at temperatures on the steam side up to 275F. (Work at vaporization temperatures of approximately 212F. (Phase I) was previously reported in R. and D. No. 272). The experiments were carried out with synthetic sea water containing components that will deposit both carbonate and sulfate scale. 7/8 in. id. x i 1/4 in. o.d. 9 ft. long controlled permeability graphite tubes were used. The rate of CaSO4 scaling was retarded but scale formation not eliminated. With bicarbonate ions formation not eliminated. With dicarbonate ions present, the pores in the permeable tube plugged rapidly with Mg (OH)2. A fundamental approach involving a laboratory study of scaling as related to size and distribution of pores in the permeable heat-transfer material was recommended if additional transfer material was recommended if additional transfer material was recommended in additional transfer material was recommended. tional work in this area is considered. (OSW Abstract) W72-02949

EVALUATION OF CONCRETE AND RELATED MATERIALS FOR DESALINATION PLANTS SECOND ANNUAL PROGRESS REPORT. Bureau of Reclamation, Denver, Colo.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price \$3.00. Office of Saline Water Research and Development Progress Report No. 390, June 1968, 345 p, 88 tab, 180 fig, 28 ref. USBR-OSW Agreement. 14-01-0001-544.

Descriptors: \*Concrete construction, \*Concretes, Descriptors: "Concrete construction, "Concretes, Flash distillation, "Pipes asbestos cement, Coatings, Construction joints, Corrosion fabrica-tion, Resins, Concrete testing, Concrete technology, Portland cements, Pozzolans, Sea water, Desalination, Prestressed concrete, Reinforced concrete, Aggregates, Binders, Concrete additives.

Laboratory tests were conducted to investigate concrete under the temperature, pressure, salinity, and structural stress conditions in a sea water distillation plant. The studies consisted of concretes containing both natural and limestone coarse aggregates exposed to a variety of temperature-pres-sure-salinity conditions, panel and module struc-tural studies-evaluation of coatings, sealants, and microstructural investigations, and stable binder investigations. Significant conclusions are (1) untreated Portland cement concrete will not withstand leaching by distilled water, (2) the high quality concrete tested has not been detrimentally affected by 2-yr exposure to 100 F flowing synthetic sea water, (3) SCME coating materials are showing promise for use on concrete and steel to 250 F, (4) degassing and drying of concrete or mortar surfaces prior to coating applications are necessary to prevent disruptions from entrapped gases and water, and (5) no significant corrosion of steel reinforcing bars or pretensioning RCDS has occurred. Several stable binders exposed to sea water at 250 F appear promising. (OSW Abstract) W72-02950

DEVELOPMENT OF IMPROVED CELLULOSE ACETATE MEMBRANES FOR REVERSE OS-MOSIS, Hercules, Inc., Cumberland, Md. Allegany Bal-

listics Lab.
M. E. Cohen, and B. M. Riggleman.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price \$0.65. Office of Saline Water Research and Development Progress Report No. 400, February 1969, 62 p, 18 tab, 11 fig, 27 ref. OSW 1-0001-1647.

Descriptors: \*Desalination, \*Reverse osmosis, Descriptors: "Desaination, "Reverse comoss, \*Membranes, \*Cellulose, Membrane processes. Identifiers: Hollow fibers, \*Composite membranes, \*Substrates, \*Regenerated cellulose nitrate, \*Ultra thin films, Crystallinity, Porosity, Compaction, Flux decline, Salt rejection, Cellulose acetate.

The preparation was investigated of improved composite desalination membranes for hollow fiber applications. The immediate objectives were to prepare and evaluate composite cellulose-cellulose acetate (CA) membranes which would provide improved resistance to flux decline and be suitable for fabricating as hollow fibers. The approach was to prepare and optimize the membrane substrate independently to achieve improved compaction pro-perties on the basis that substrate compaction is a significant factor contributing to membrane flux decline and to select substrates whose properties and fabrication processes satisfy hollow fiber requirements. The substrates were to be coated directly with an ultrathin film of CA to form a comor certify with an ultratum film of CA to form a com-posite desalination membrane. Regenerated cellu-lose substrates were emphasized in this work because of the potential for developing high degrees of crystallinity and high crosslink densities in a substrate, both of which should retard creep compaction. Nitrocellulose was also studied as a substrate material based upon previous experience dealing with the preparation of porous gelled struc-tures. (OSW Abstract) W72-02951

ACTIVATED CARBON USED AS ELECTRODES IN ELECTROCHEMICAL DEMINERALIZA-TION OF SALINE WATER.

Oklahoma Univ., Norman.
G. W. Murphy, and J. L. Cooper.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price \$1.00. Office of Saline Water Research and Development Progress Report No.

#### Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

#### Group 3A-Saline Water Conversion

99, 102 p, 26 fig, 3 tab, 68 ref. OSW14-01-0001-

Descriptors: \*Demineralization. Desalination. Electrochemistry, Desalination processes, Cation exchange, Cation adsorption, Brackish water, Activated carbon, Electrodes.

Electrode systems have been developed capable of demineralizing brackish waters. The cation responsive electrodes are constructed from chemically activated powdered porous charcoal and graphite. Aqueous slurries of the increased capacity cationresponsive material are deposited in paste form upon the surfaces of an inert porous backing material. Use was made of this activated cationic responsive carbon electrode, in combination with anion responsive electrodes, in the fabrication of a small demineralization test cell. The electrochemical properties of the demineralization test cell are summarized based on the use of chemically activated charcoal-graphite cation responsive electrodes. (OSW Abstract) W72-02952

#### 3B. Water Yield Improvement

SUMMARY OF WATER RESOURCES OF SALT

LAKE COUNTY, UTAH, Geological Survey, Salt Lake City, Utah. For primary bibliographic entry see Field mary bibliographic entry see Field 04B. W72-02273

WATER RESOURCES OF PUERTO RICO. PHASE II: GROUND WATER APPRAISAL.

Domenech (R.A.) and Associates, Hato Rey (Puerto Rico); and Black and Veatch, Kansas City, Mo. ary bibliographic entry see Field 04B. W72-02291

DECISION AND INSTITUTIONAL ASPECTS OF WEATHER MODIFICATION,

Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physcs. For primary bibliographic entry see Field 06E. W72-02299

YIELDS AND SPECIFIC CAPACITIES OF BEDROCK WELLS IN KENTUCKY,

Geological Survey, Louisville, Ky. For primary bibliographic entry see Field 04B. W72-02305

REALISTIC RAINFALL SIMULATION FOR FIELD INVESTIGATION,

Arizona Univ., Tucson. Water Resources Research

J. Morin, C. B. Cluff, and W. R. Powers American Geophysical Union, Fifty-First Annual Meeting, Washington, D.C., Preprint, April 24, 1970. 22 p, 7 fig, 2 tab, 13 ref. OWRR B-015-ARIZ

Descriptors: \*Rainfall simulators, \*Rainfall intensi-ty, \*Raindrops, \*Infiltrometers, \*Instrumentation, Nozzles, Infiltration, Spraying, Reliability, Uniform flow, Impact (Rainfall), Arizona.

A review of rainfall-simulation problems (low in-A receive of raintan-simulation proteins (few intensity, realistic drop size, high impact velocity) and simulators (drip and nozzle types) is presented. A realistic field simulator, developed by the University of Arizona, using the rotating disk and suitable for infiltration determinations is described and compared with other models. The simulator utilizes a large full-cone-spray nozzle, which produces an intensity of 1540 mm/hr. when elevated 2 meters and operated at 0.6 atmospheres pressure. Realistic infiltration data and close duplication of natural rainfall was observed in over 250 runs. Intensity may be varied without significantly changing drop-size distribution or uniformity. (Popkin-Arizona) W72-02433

INTERBASIN TRANSFERS OF WATER.

Colorado Univ., Boulder. Dept. of Economics; and Minnesota Univ., Minneapolis. Dept. of Economics. C. W. Howe, and K. W. Easter.

Published for Resources for the Future, Inc., Washington, D.C., by the Johns Hopkins Press, Baltimore and London. 1971. 196 p, 15 fig, 65 tab,

Descriptors: \*Inter-basin transfers, \*Economic impact, \*Cost-benefit analysis, \*Planning, Methodology, Administration, Water resources development, Water conveyance, Reclamation,

Identifiers: \*Regional impact.

The economic desirability of large-scale interbasin transfers in the western United States is assessed, and the variety of economic impacts that such transfers can have on both local and far-removed regions is emphasized. Analysis suggests that in most circumstances the national economic benefits from using the water provided would be less than the cost of the transfers. Direct benefits to the cost of the transfers. Direct benefits to established agriculture were found to range from zero to \$45 per acre-foot, but most areas fell in a \$10-\$20 per acre-foot range. Total benefits were found to range from \$14-\$120 per acre-foot with the higher values occurring only under conditions of extreme labor and capital mobility. Cost figures for major transfers tended to fall in the range of \$50-\$60 per acre-foot, suggesting that transfers cannot generally be justified on economic grounds. This inference seems particularly valid when alter-native sources of additional water supply are considered. These alternatives include reduction of conveyance losses, additional surface development, and wastewater reclamation. These conclusions point to a need for more inclusive evaluations in water resources planning and design. Various methodologies which would be useful in that direction are demonstrated. (Settle-Wisconsin) W72-02436

ON THE ECONOMIC IMPACT OF LARGE DIVERSIONS OF SNAKE RIVER WATERS, Washington State Univ., Pullman. Dept. of Mathematics; and Washington State Univ., Pullman, Washington. Water Research Center. For primary bibliographic entry see Field 06A. W72-02448

NATURAL RESOURCES AND THEIR DEVELOPMENT IN MAHENDRAGARH DISTRICT OF HARYANA STATE, Central Arid Zone Research Inst., Jodhpur (India).

B. B. Roy, R. K. Gupta, and S. Pandey.
Ann Arid Zone 9 (2): 65-76. Map. 1970.
Identifiers: Arid, Development, Erosion, Haryana, India, Mahendragarh, Natural, \*Resources, Temperature, Wind, Zone. Rainfall.

Mahendragarh district stretches from latitude 27 deg 47' to 28 deg 49' N and longitude 75 deg 49' to 66 deg 28' E and has an area of about 3474 km2. It consists of 2 bioclimatic regions, namely arid and semi-arid zones. Maximum temperature of 41 deg - 42 deg C sometimes rising to 47 deg C is recorded in May and June, while the minimum temperature is recorded in Dec.-Jan. The annual rainfall varies from 300 to 500 mm. The desertic soils with sandy to loamy sand texture are found in the arid part, and soils belonging to sierozems are found in the semi-arid part. The main problems are shifting sand dunes, severe wind erosion, degraded pastures and scarcity of water. Recommendations for solving these problems are made.--Copyright 1971, Biological Abstracts, Inc. W72-02713

NATURAL RESOURCES RESEARCH, VOL. VII. AGROCLIMATOLOGICAL METHODS.

Illus, Unesco: Paris, France, Symposium, 392 p.

Identifiers: \*Agroclimatological, Methods, Natural, Plants, Resources, Symposium

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This volume contains the proceedings of the UNESCO Symposium held at the University of Reading, United Kingdom, on July 23-30, 1966. Written in both English and French, this symposium presents a critical review of the current progress of methods of measurement, analysis and progress of methods of measurement, analysis and presentation in agroclimatologic studies. The conference notes the complementary questions of the relationship between plants and their environment at a micro- and meso- level. The main areas of conat a micro- and meso-level. In emain areas of con-cern are: the use of agroclimatologic data and its availability; primary and secondary effects of weather, including the epidemiology of plants and diseases; agroclimatologic surveys; and the progress in applied agricultural climatology. Spe-cial emphasis is on FAO/UNESCO/World Meteorological Organization surveys already completed in the Near East and in Western Africa (as of July 1966). Climatic change, man's effect on (as of July 1966). Climatic change, man's effect on weather modification through the provision of irrigation and shelter, human and social influences on land use and agrometeorological problems are also discussed.--Copyright 1971, Biological Abstracts, Inc. W72-02734

**EVALUATION OF CLOUD SEEDING DEVICES** 

IN AN OUTDOOR LABORATORY.
Wyoming Univ., Laramie. Natural Resources
Research Inst. For primary bibliographic entry see Field 02B. W72-02752

RETARDED STOMATAL CLOSURE BY PHEN-YLMERCURIC ACETATE, California Univ., Davis. Dept. of Water Science

Engineering. D. C. Davenport, M. A. Fisher, and R. M. Hagan. Physiol Plant. 24 (2): 330-336. Illus. 1971.

Injantania. Acetate, Cell, Closure, Guard, Light, Membrane, Mercuric, Nerium-Oleander-D, Permeability, Phaseolus-Vulgaris-D, Phenyl, Retarded, Stomatal, Transpiration, Vicia-Faba-D.

Excised leaves of Nerium oleander, which were treated with phenylmercuric acetate (PMA) 1.5 hr treated with phenylmercuric acetate (PMA) 1.5 hr before excising, transpired faster than untreated excised leaves. Similarly, PMA-treated oleander plants transpired more than untreated plants in the dark. These effects were due to retarded stomatal closure caused by PMA. Measurements of stomatal apertures on disks of Vicia faba leaves kept in the dark, and of diffusive resistance to water vapor from Phaseolus vulgaris leaves, confirmed that PMA retards stomatal closing as well as stomatal pmAn retards stomatal closing as well as stomatal opening. However, day time reductions in transpiration by PMA greatly exceed nighttime increases in water loss. The mechanisms of stomatal movement, as affected by PMA, are discussed. PMA may conceivably decrease the permeability of guard cell membrane to solutes, thereby retarding all stomatal movements that are osmotically induced.--Copyright 1971, Biological Abstracts, Inc. W72-02932

# 3C. Use of Water of Impaired

USE OF SALT WATERS PREDOMINANT IN DIVALENTCATIONS FOR IRRIGATION IN THE SEMI-ARID ZONE OF WESTERN

THE SEMI-ARID ZONE OF WESTERN RAJASTHAN, Central Soil Salinity Research Inst., Karnal (India). I. C. Gupta, and C. T. Abichandani. Indian J Agr Sci. 40 (8): 711-715. 1970. Identifiers: Arid, Availability, Calcium, Cations, Divalent, Exchangeable, India, Irrigation, Magnesium, Predominant, Rajasthan, Saline, Salt, Semi, Sedium, Sail Zone.

Sodium, Soil, Zone.

Irrigation with this water resulted in the accumulation of soluble salts in deep-sandy to sandy-loam

#### WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Conservation in Agriculture—Group 3F

soil, but the pH and the concentration of soluble and exchangeable Na did not reach harmful amounts in the root zone of the soils. The Na-abamounts in the root zone of the soils. The Na-ab-sorption ratio and the percentage of exchangeable Na of the irrigated soil were low and the availability of dissolved Ca and Mg ions was high. The salinity problem can be controlled through leaching by rainfall, and liberal irrigations, in the following winter (rabi) season.—Copyright 1971, Biological Abstracts Day Abstracts, Inc. W72-02514

INFLUENCE OF SALINITY ON GERMINA-TION, VEGETATIVE GROWTH, AND GRAIN YIELD OF RICE (ORYZA SATIVA VAR. DU-

Indian Inst. of Tech., Kharagpur.
For primary bibliographic entry see Field 021.
W72-02799

#### 3D. Conservation in Domestic and **Municipal Use**

WATER RESOURCES PLANNING IN URBAN

DEVELOPMENT,
Wapora, Inc., Washington, D. C.
For primary bibliographic entry see Field 06B.
W72-02294

THE RANGE OF CHOICE IN URBAN WATER MANAGEMENT: DEMAND MANAGEMENT THROUGH RESPONSIVE PRICING, Johns Hopkins Univ., Baltimore, Md. For primary bibliographic entry see Field 06C. W72-02432

RESIDENTIAL WATER DEMAND AND ECONOMIC DEVELOPMENT, For primary bibliographic entry see Field 06D. W72-02457

ECONOMIC ANALYSIS OF WATER SUPPLY ALTERNATIVES IN A MULTI-COUNTY IN-

DUSTRIAL AREA,
Clemson Univ., S.C. Dept.
Economics and Rural Sociology. Dept. of Agricultural For primary bibliographic entry see Field 06B. W72-02458

URBAN WATER RESOURCES MANAGEMENT
- 3RD CONFERENCE ON URBAN WATER
RESOURCES RESEARCH, JULY 27-31, 1970,
DEERFIELD, MASSACHUSETTS, SPONSORED
BY THE URBAN WATER RESOURCES
RESEARCH COUNCIL OF THE HYDRAULICS
DIVISION OF THE AMERICAN SOCIETY OF
CIVIL ENGINEERS.
American Society of Civil Engineers New York

American Society of Civil Engineers, New York. For primary bibliographic entry see Field 06B. W72-02473

URBAN WATER PLANNING AND MANAGE-MENT: A CONCEPTUAL FRAMEWORK AND PROBLEM FOCUS, Chicago University, Ill. Center for Urban Studies. For primary bibliographic entry see Field 06B. W72-02474

BASIC NEEDS OF URBAN WATER MANAGE-MENT ON THE FIRING LINE, Denver Water Dept., Colo.

For primary bibliographic entry see Field 06B. W72-02475

URBAN WATER RESOURCES MANAGEMENT DIMENSIONS,
Department of Housing and Urban Development,
Washington, D.C. For primary bibliographic entry see Field 06B. W72-02476

URBAN WATER MANAGEMENT NEEDS IN RUNOFF AND FLOOD REGULATION, Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering. For primary bibliographic entry see Field 06B. W72-02478

INTEGRATED MANAGEMENT OF METROPOLITAN WATER SERVICES, New York State Dept. of Environmental Conserva-tion, Albany. Div. of Water Research. For primary bibliographic entry see Field 06B. W72-02479

SOME NOTES ON APPROACHES AND VIEW-POINTS OF PRIVATE AGENCIES TO METROPOLITAN WATER MANAGEMENT, Reitz and Jens, Inc., St. Louis, Mo. For primary bibliographic entry see Field 06B. W72-02480

AN OVERVIEW OF CONTEMPORARY AP-PROACHES AND CONCEPTS IN METROPOLITAN WATER MANAGEMENT, Office of Water Resources Research, Washington, For primary bibliographic entry see Field 06B. W72-02483

THE INTEGRATING PLANNING MANAGEMENT OF METROPOLITAN WATER RESOURCES INTO A REGIONAL CONTEXT, National Water Commission, Arlington, Va. For primary bibliographic entry see Field 06B. W72-02484

NATURE OF AND NEED FOR INTERDISCIPLI-NARY ATTACKS ON PROBLEMS OF URBAN WATER MANAGEMENT. Colorado Univ., Boulder. Center for Urban Engineering Studies. For primary bibliographic entry see Field 06B. W72-02486

#### 3E. Conservation in Industry

INDUSTRIAL WATER REUSE: FUTURE POL-LUTION SOLUTION,

Environmental Protection Agency, Washington, D.C. Office of Research and Monitoring. For primary bibliographic entry see Field 05D. W72-02454

#### 3F. Conservation in Agriculture

EFFECTIVENESS AND PERSISTENCE OF BROMACIL AND KARBUTILATE APPLIED USING FIXED- AND ROTARY-WING AIRCRAFT.

Texas A and M Univ., College Station. Dept. of Range Science. For primary bibliographic entry see Field 04A. W72-02267

ANALYSIS OF ALTERNATIVE PROCEDURES FOR THE EVALUATION OF AGRICULTURAL FLOOD CONTROL BENEFITS, VOLUME II, Economic Research Service, Washington, D. C. For primary bibliographic entry see Field 06B. W72-02269

AGRICULTURAL FLOOD CONTROL. BENEFITS AND LAND VALUES. Corps of Engineers, Alexandria, Va. Inst. for Water Resources. For primary bibliographic entry see Field 06B. W72-02270

EFFECTIVENESS OF POSITIVE MEASURES ON THE WATER BALANCE OF AGRICUL-TURAL LANDS (EFFEKTIVNOST'AKTIVNOGO VOZOEYSTVIYA NA VODNYY BALANS SEL'-SKOKHOZYGYST VENNYKH UGODI), Akademiya Nauk SSSR, Moscow. Institut Geografii. For primary bibliographic entry see Field 04A. W72-02311

HOUSE FLY PUPAE AS FOOD FOR POULTRY, Agricultural Research Service, Beltsville, Md For primary bibliographic entry see Field 05E. W72-02383

IRRIGATION DEVELOPMENT COST AT THE

FARM LEVEL,
Food and Agriculture Organization of the United
Nations, Bangkok (Thailand).
B. D. van't Woudt.

International Commission on Irrigation and Drainage Bulletin, p 33-46, January, 1970. 7 tab, 12 ref, 2 append.

Descriptors: \*Irrigation programs, \*Costs, \*Government supports, Crop production, Farm management.
Identifiers: \*Farm development.

To stimulate farm development, an active, financially supported farm programme in conjunction with a water resources project is necessary. Effec-tive water resource planning requires the identification and evaluation of the programme costs. One source of costs is irrigation service area development. This includes costs for the alternative development method of land consolidation, water lifting at the farm level, partial development of the service area and block development as well as farm roads. Another cost is farm development, which includes land leveling and smoothing, land preparation and drainage. Governmental support costs in irrigated areas include those for services and assistance needed to improve farm production, the farmer's standard of living and to secure a return on investment. At the time of project approval, multi-purpose farmer's associations should be established. Farmer cooperation in the programme's operation and maintenance and improved farming skills through a governmental information and education service are vital. On ECAFE pro-jects where funds have been provided to meet the full farm development programme, production has reached anticipated levels within the development period. (Haugh-Wisconsin) W72-02443

ARIZONA'S WATER ALLOCATION STUDY: AN ECONOMIC PLANNING REVIEW.

Arizona State Dept. of Economic Planning and Development. Phoenix. For primary bibliographic entry see Field 06A. W72-02444

EFFECTS OF INTERBASIN TRANSFERS UPON WATER MANAGEMENT ALTERNATIVES IN CENTRAL UTAH,

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 06D. W72-02450

NIGHT-TIME SINK STRENGTHS AND AP-PARENT DIFFUSIVITIES WITHIN A CORN

CANOPY, Guelph Univ. (Ontario). Dept. of Soil Science. T. J. Gillespie, and K. M. King.
Agr Meteorol. 8 (1): 59-67. Illus. 1971.
Identifiers: Canopy, Corn-M, Diffusivities, Heat, Night-time, Sensible, Sink, Strengths, Tempera-

Night-time sink-strength profiles for moisture in a corn canopy were determined by blotting dew from

#### Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

#### Group 3F-Conservation in Agriculture

leaves. Air temperature and specific humidity in the canopy air layer were also measured. From the usual flux-gradient equation some apparent night-time diffusivity profiles for water vapor were deduced. These curves reached a minimum near the middle of the air layer occupied by the foliage, in contrast to corresponding day-time profiles which monotonically decrease with depth. Sensible heat was a stronger contributor of energy to the crop at night than was latent heat, but moisture sinks were more evenly distributed in the foliage.—Copyright 1971, Biological Abstracts, Inc. W72-02500

EFFECT OF VARYING LEVELS OF IRRIGA-EFFECT OF VARYING LEVELS OF IRRIGA-TION, PLANT POPULATION AND FERTIL-IZER ON YIELD AND QUANTITY OF INDIAN RAPE (BRASSICA CAMPESTRIS L. VAR. TORIA DUTH AND FULL.), Indian Council of Agricultural Research, Sirsa (In-dia). Regional Research Station. N. P. Wankhede, I. P. S. Ahlawat, and V. M. Sahni.

Indian J Agr Sci. 40 (10): 873-877. 1970.

Identifiers: Brassica-Campestris-Var-Toria-D, Fertilizer, Indian, Irrigation, Nutrition, Oil, Plant, Population, Rape-D, Yield.

Three irrigations proved optimum and gave favorable response in growth, fruiting and grain yield/ha. Plant height was slightly greater with 4 irrigations. irrigation levels did not produce any marked influence on the oil content of the seed. Plant population of 166,000 plants/ha gave the highest grain yield. The number of branches and capsules/plant were more with 111,000 plants/ha, but the height did not show any difference among the 3 plant populations. The oil content of the seed with 166 and 111 thousand plants/ha was slightly better than with 333,000 plants/ha. Application of 40 kg N .. 20 kg P2O5/ha increased the number of branches, capsules/plant and grain yield, whereas at higher fertilizer level the trend was reversed. The height of the plant continued to increase with higher levels of fertilizer, but the oil content of the seed was reduced with fertilizer application.--Copyright 1971, Biological Abstracts, Inc. W72-02506

PHYSIOLOGICAL SIGNIFICANCE OF ASCOR-BIC ACID IN RELATION TO DROUGHT RE-SISTANCE IN RICE (ORYZA SATIVA L.), Banaras Hindu Univ., Varanasi, (India). Coll. of

Agriculture; and Banaras Hindu Univ., Lab. of Plant Physiology. O. K. Garg, and B. P. Singh.

Plant Soil. 34 (1): 219-223. Illus. 1971.

Identifiers: Ascorbic-Acid, Drought, Oryza-Sativa-M, Physiological, Relation, Resistance, Rice-M,

Two high-yielding rice cultivars, Taichung Native-1 and I.R. 8 were grown in soil with 7-10 and 15-20% moisture at field capacity. Wilting treatments were given only at tillering and shooting stages. Taichung Native-I was more resistant. Its leaves showed greater contents of ascorbic acid and ascorbigen following increased rate of ascorbic acid utilization as compared to I.R. 8. These values were significantly reduced during shooting stage, a critical period to drought.--Copyright 1971, Biological Abstracts, Inc.
W72-02507

EXPERIMENTS ON THE FERTILIZING VALUE OF ANIMAL SLURRIES: III. THE USE OF POULTRY AND MIXED SLURRIES ON GRASS-

LAND, National Agricultural Advisory Service, Yorkshire (England). H. T. Davies, and C. G. Chumbley.

Exp Husb. 19. 65-68. 1970.

Identifiers: Animal, Fertilizing, Grassland, Mixed, Nitrogen, Nutrition, Poultry, Slurries, United King-

Good responses in yield, generally significant, were obtained from fertilizer N and the N in slurries. At the Yorkshire site, there was no difference in yield from applying increments of poultry slurry at intervals in winter than from applying the total amount in spring. The efficiency of the N in the slurry was estimated at 68%. At the Shropshire site, there were small differences, not statistically significant, between times of application indicating efficiency of the N content increasing from 50% for application in Oct. to nearly 100% for application in Feb. Soil and rainfall data are given.—Copyright 1971, Biological Abstracts, Inc.
W72-02508 the Yorkshire site, there was no difference in yield

PHYSIOLOGICAL RESPONSES OF SORGHUM AND MAIZE LEAVES TO WATER STRESS: III. TRANSPIRATION RESPONSES OF CUT LEAVES IN DESICCATION EXPERIMENTS (IN SPANISH), Instituto de Edafologia y Biologia Vegetal, Madrid

M. F. Sanchez-Diaz, M. Morey, and F. Gonzalez-

An Edafol Agrobiol. 29 (3/4): 253-263. Illus. 1970.

English summary.
Identifiers: Cut, Desiccation, Leaves, Maize-M,
Physiological, Sorghum-M, Stomata, Stress, Trans-

Water losses from cut leaves of sorghum and maize were compared in series of parallel experiments under standard conditions. For nonstressed leaves and under comparable conditions water loss from sorghum leaves was much higher (about 3 times) than in maize, both when expressed in terms of surface or dry weight. Transpiration reduction (probably by stomatal closure) seemed to take place for lower water deficits in maize than in sorghum. Nevertheless, stress-induced transpira-tion reduction in sorghum was more efficient in terms of rate and proportional decrease.--Copyright 1971, Biological Abstracts, Inc. W72-02539

EVIDENCE FOR ACTIVE WATER TRANS-PORT IN A CORN ROOT PREPARATION, Hebrew Univ., Jerusalem (Israel). Dept. of Botany.

H. Ginsburg, and B. Z. Ginzburg.

J Membrane Biol. 4 (1): 29-41. Illus. 1971.
Identifiers: Corn-M, Cyanide, Flow, O
Preparation, Root, Transport, Zea-Mays-M. Osmotic,

Water flow was measured in a Zea mays root preparation consisting of a segment from which the central part had been excised. It was shown that water flow had 2 components, one osmotic and one nonosmotic. The nonosmotic flow was inhibited by cyanide. No correlation was found between water flow and solute flow. These findings suggest that active water transport occurred in the root preparation. The mechanism of such water movement is discussed.—Copyright 1971, Biological Abstracts, Inc. W72-02541

SOIL MOISTURE AND THE INFECTION OF YOUNG POTATO TUBERS BY STREPTO-MYCES SCABIES (COMMON SCAB), Rothamsted Experimental Station, Harpenden

(England). D. H. Labwood, and T. F. Hering.

Potato Res. 13 (4): 296-304. Illus. 1970. Identifiers: Infection, Irrigation, Moisture, Potato-D, Scrab, Soil, Streptomyces-Scabies, Time, Tu-

'Majestic' potatoes planted in soil naturally infested with Streptomyces scabies were trickle irrigated to prevent infection of the tubers except during consecutive 7-day periods in the 1st 8 wk when tubers were developing (May 28-July 23). During each interval without irrigation, lesions of scab affected an average of 4 internodes on the tubers but the later water was withheld, the closer to the apex of the tu-bers was the infection at final lifting. The tubers

with most area scabbed were those unwatered between June 11 and 18, the 3rd wk from tuber inverween June 11 and 18, the 3rd wk from tuber initiation, when the first-formed internodes, which expand more than later-formed ones, became infected.—Copyright 1971, Biological Abstracts, Inc. W72-02542

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EFFECTS OF BOTTOM DEFOLIATION ON MICROCLIMATE AND THE REDUCTION OF BOLL ROT OF COTTON, Agricultural Research Service, Beltsville, Md. Plant Science Research Div. C.D. Ranney, J.S. Hursh, and O.H. Newton. Argon J. 63 (2): 259-263. Illus. 1971.

Identifiers: Boll, Bottom, Climate, Control, Cotton-D, Defoliation, Disease, Humidity, Intensity, Light, Micro, Reduction, Rot, Ventilation.

In 1963 and 1964, increases in boll rot of cotton were associated with short periods (5-7 days) of rainfall and, to a lesser extent the drying period following rainfall. Microclimate changes within the plant canopy associated with these periods indicate that increased duration of relative humidity at a level of 95% or higher, increased duration of free level of 95% or higher, increased duration of free moisture, and reduced intensity of light favor boll rot development. Bottom defoliation reduced boll rot loss and modified the microclimate resulting in shorter duration of 95% or higher relative humidity; it increased light intensity in the lower plant zone, and possibly increased ventilation following periods of rainfall. Instrumentation used for microclimate measurements are described, and periods of raintail. Instrumentation used for microclimate measurements are described; and construction details of a simple mechanical psychrometer and a light intensity sensor-recorder are presented.—Copyright 1971, Biological Abstracts, Inc.
W72-02543

THE RESPONSE OF MUCKGROWN CARROTS TO FUMIGATION AND SOIL WATER STRESS, Department of Agriculture, Agassiz (British

Department of Agriculture, Agassiz (British Columbia). Research Station.

A. R. Maurer, J. R. Canroy, and T. K. Watson.
Hortscience. 6 (1 Sect 1): 42-43. 1971.
Identifiers: Bromide, Carrots-D, Fumigation,
Grown, Irrigation, Methyl, Muck, Pythium-Debaryanum, Soil, Stress.

Soil fumigation with methyl bromide greatly reduced Pythium debaryanum infection on carrots in pot experiments. The yield of carrots in fumigated soil responded to irrigation but did not respond in non-fumigated soil. A soil water stress equivalent to 20% of available water at field capacity produced the poorest yield. —Copyright 1971, Biological Abstracts, Inc.

THE PROBLEM OF FOREST SHELTERBELTS FOR THE COLCHIS LOWLAND., (IN RUS-SIAN), S. V. Mgaloblishvili.

Subtrop Kult. 5. 123-128. 1968.

Identifiers: Colchis, Forest, Grecian, Laurel-D, Lemon-D, Lowland, Mandarin-D, Orange-D, Productivity, Shelterbelts, Spacing, Tea-D, USSR,

Previous experience of the effect of forest shelterbelts on the increase of productivity of citrus plants and other subtropical plantations is described. Four to 6-row strips are effective in regions with strong wind, whereas in less windy localities, 2-row strips are sufficient. For mandarin and orange orchards the distance between the forest strips should be 120 m, for lemon 100 m, for tea and Grecian laurel m, for lemon 100 m, for tea and Grecian laurel 150-180 m. Windpermeable belts with an open canopy should be created. Shelterbelts should be planted with a 2x2 m spacing between trees. Planting should be done from 15 Oct. to 1 Dec. and from 15 Feb. to 1 April with 1-yr-old or 2-yr-old saplings no less than 40-50 cm high. After planting, the plants should be tied to stakes. --Copyright 1971, Biological Abstracts, Inc. W72-02552

#### WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Conservation in Agriculture—Group 3F

AFTER-EFFECT OF DROUGHT ON WATER CONDITIONS AND GROWTH OF TEA SEEDLINGS, (IN RUSSIAN),

L. A. Filippov. Fiziol Rast. 17 (1): 123-127. Illus. 1970. English summary. Identifiers: Drought, Growth, Seedlings, Tea-D.

Increase of cell sap concentration (CSC) in tea shoots from plants cultivated on unirrigated planta-tions is a physiological process which quantitatively tions in a physicographic service which quantitatively (in percent) corresponds to decrease of the water content of their tissues. After drought treatment of the plants the water-absorbing capacity of the tea shoots and magnitude of the CSC change on shoots and magnitude of the CSC change on complete saturation with water. The after-effect of drought is accompanied by a depressions of flush growth which equals 5-7 days when the CSC is increased to 11-12%, 12-14 days for CSC of 14-15% and 18-20 days for an 18-20% CSC. The aggravates the direct negative influence of drought after heavy rain or abundant irrigation.—Copyright 1971, Biological Abstracts Inc. Biological Abstracts, Inc. W72-02553

PROPAGATION OF THE GOOSEBERRY BY ROOTING OF SOFT CUTTINGS UNDER THE CONDITIONS OF AUTOMATIC MIST-SPRA-

Instytut Sadownictwa, Skierniewice (Poland). A. Czynczyk.

Pr Inst Sadownictwa Skierniewicach. 12: 3-12. Illus. 1968. Russian and English summaries. Identifiers: Alpha, Automatic, Cuttings, Gooseber-ry-D, Growth, IAA, Mist, Napthaleneacetic-Acid, Powder, Propagation, Regulators, Rooting, Shoot, Soft, Spraying.

Soft cuttings (15 and 18 cm long) of 2 gooseberry cultivars: 'White Smith' and 'Lady Delamere' were treated for 24 hr with different growth regulators: alpha-naphthaleneacetic acid (NAA) at 10 and 25 mg/l; IAA at 50, 100, and 150 mg/l, and a commercial, ready-to-use preparation 'Rooting Powder.' Averages of 80% and 51% of rooted cuttings were obtained of the cultivars 'Lady Delamere' and White Smith,' respectively. Under high humidity of air and soil, growth-promoting substances had no air and soil, growth-promoting substances had no significant bearing on the number and grade of rooted cuttings. To obtain good rooting results, it is growth of shoots has subsided.—Copyright 1971, Biological Abstracts. Inc. Biological Abstracts, Inc. W72-02555

POLYSACCHARIDES IN SOILS, For primary bibliographic entry see Field 02G. W72-02557

THE EFFECTS OF WATER STRESS ON NITROGEN-FIXING ROOT NODULES: I. EFFECTS ON THE PHYSIOLOGY OF DETACHED SOYBEAN NODULES,

Dundee Univ. (Scotland). Dept. of Biological

Janet I. Sprent New Phytol. 70 (1): 9-17. Illus. 1971.

Identifiers: Acetylene, Bean-D, Detached, Fixing, Nitrogen, Nodules, Physiology, Reduction, Respiration, Rhizobium-Japonicum, Root, Soy, Stress, Structural, Turgor.

When the fresh weight of detached soybean nodules (from plants inoculated with Rhizobium japonicum) is reduced below 80% of its maximum (fully turgid) value, irreversible changes occur. (fully turgid) value, irreversible changes occur. Acetylene and N reducing activities cease, respiratory rates become very low and there are gross structural changes. Such modules are probably shed by the plant. Reduction of water content down to 80% of the maximum fresh weight, leads to a proportionate slowing down of acetylene reduction, with a concomitant reduction in respiratory activity.—Copyright 1971, Biological Abstracts, Inc. Inc. W72-02633

THE EFFECT OF HYDRATION-DEHYDRATION ON SEED GERMINATION, Glasgow Univ. (Scotland). A. M. M. Berrie, and D. S. H. Drennan A. M. Berrie, and D. S. H. Drennan. New Phytol. 70 (1): 135-142. Illus. 1971. Identifiers: Avena-Sativa-M., Cell, Dehydration, Desiccation, Embryo, Enlargement, Germination, Hydration, Imbibition, Lycopersicum-Esculentum-D, Oats-M, Protease, \*Seed, Tomato-D.

Seeds of tomato (Lycopersicum esculentum) and oats (Avena sativa) were subjected to hydration-dehydration treatments at various times during germination. Desiccation has little harmful effect if carried out before cell division and enlargement has commenced. Some advancement of the onset of germination was apparent, due probably to slight changes in the seed covering and also to the initia-tion of metabolic events which could withstand the dehydration, e.g. the increased protease activity was maintained in the dried seed. Dehydration can was maintained in the dried seed. Denydration can be done more than once. The effects are only truly accumulative if the prior imbibitions are of sub-stantial duration. Physical changes associated with hydration are fairly easily reversed but some of the chemical changes beginning in oat within 8-12 hr of imbibition cannot be returned to the original dry seed condition by desiccation. Once embryo growth is apparent, embryo damage of some sort usually results.—Copyright 1971, Biological Abstracts, Inc. W72-02634

EFFECTS OF WATERLOGGING ON THE GIB-BERELLIN CONTENT AND GROWTH OF TO-MATO PLANTS,

Calgary Univ. (Alberta). Dept. of Biology. D. M. Reid, and A. Crozier. J Exp Bot. 22 (70): 39-48. Illus. 1971. Identifiers: Elongation, \*Gibberellin, Grow Plants, Roots, Stem, \*Tomato-D, Waterlogging. Growth.

Flooding of tomato roots results in decreased stem growth. We have shown that flooding will reduce levels of gibberellins (GA) in the roots, shoots, and bleeding sap of tomato plants. The adventitious roots that appear on the 3rd day of waterlogging may be responsible for the production of GA that accumulate in the shoot after 3-4 days of flooding. accumulate in the shoot after 3-8 days of flooding. The endogenous GA of tomato will stimulate stem growth of tomato plants. Initially, application of GA3 will stimulate the growth of flooded plants to a greater extent than that of nonwaterlogged plants. It is suggested that one of the 1st effects of flooding is to reduce GA levels and so inhibit stem less effective and other factors appear to inhibit shoot growth.--Copyright 1971, Biological Abstracts, Inc. stracts, Inc. W72-02635

RESISTANCE TO WATER ABSORPTION IN GERMINATING RAPESEED (BRASSICA

MAPUS L.),
Manitoba Univ., Winnipgeg. Dept. of Soil Science.
C. F. Shaykewich, and John Williams.
J Exp Bot. 22 (70): 19-24. Illus. 1971. Identifiers: Absorption, Brassica-Napus-D, Conductivity, Germinating, Hydraulic, Imbibition, Permeability, \*Rape-D, Resistance, Seed, Soils.

Dynamics of the imbibition phase of rapeseed (Brassica napus) was studied by evaluating water content-water potential relations and the permea-bility to water. It was found that resistance to water absorption was very high (diffusivity was very low) during the early stages of water absorption. As weed water content increased, resistance decreased by more than 6 orders of magnitude. The decreased by more than 6 orders of magnitude. The concept of hydraulic conductivity of a seed was introduced. The change in hydraulic conductivity with change in seed water content was similar to that observed for diffusivity. It was shown that at late stages of water absorption hydraulic conductivity approached values found in soils at the dry end of the available water range. For this reason it was suggested that hydraulic conductivity in soil may have an influence on imbibition rate in the late

stages of water absorption.--Copyright 1971, Biological Abstracts, Inc. W72-02636

WATER CONGESTION OF PEA, PISUM SATIVUM, Wisconsin Univ., Madison. Dept. of Plant Patholo-

gy. D. J. Hagedorn, and R. E. Rand. Plant Dis Report. 55 (3): 249-253. Illus. 1971. Identifiers: Congestion, High, Humidity, Moisture, \*Pea-D, Pisum-Sativum-D, Soil, Temperature,

A nonparasitic disease of processing pea termed 'water congestion' was characterized by a gradual necrosis of the foliage which progressed inward toward the midvein from the outer edges of leaves and stipules. Sometimes up to 75% of the foliage surface at several nodes of the plant was destroyed. No pathogen was associated with this disease, which appeared most commonly under conditions of high soil moisture, high relative humidity, and warm temperatures. Early maturing pea cultivars were sometimes more susceptible.—Copyright 1971, Biological Abstracts, Inc.

ATRIPLEX POLYCARPA: I. GERMINATION AND GROWTH AS AFFECTED BY SODIUM CHLORIDE IN WATER CULTURES,

California Univ., Riverside. Dept. of Agronomy. N. Jerry Chatterton, and Cyrus M. McKell. Agron J. 61 (3): 448-450. Illus. 1969. Identifiers: Atriplex-Polycarpa-D, Chloride, Cultures, Desert, Germination, Growth, Osmotic, Population, Potential, Salt, Saltbrush-D, Sodium, Tolerance.

Atriplex polycarpa (Torr.) S. Wats. (desert salt-brush) seed was found to have the same general range of salt tolerance during germination as the Australian saltbushes. Germination was severely reduced by solutions having osmotic potentials of -4.2 atmospheres or less. Growth of established seedlings, although reduced, was not inhibited by securings, atmosph reduced, was not innoted by solutions having osmotic potentials of -25 at-mospheres. Dry weight of plants in a given NaCl solution varied among populations indicating some populations are more salt tolerant than others. Root growth was somewhat correlated to top growth, however, salt restricted top growth more than root growth resulting in increased root/top ratios as the level of salinity increased. Only the highest concentration of NaCl used reduced root length. There was no correlation between percent moisture in top growth of desert saltbush and the osmotic potential of the water culture. Desert saltbush was found to be extremely tolerant of NaCl when grown under the conditions of this study.— Copyright 1971, Biological Abstracts, Inc. W72-02701

RESOURCES DEVELOPMENT IN MAHENDRAGARH DISTRICT OF HARYANA STATE,

Central Arid Zone Research Inst., Jodhpur (India). For primary bibliographic entry see Field 03B. W72-02713

EFFECTS OF SPRINKLER IRRIGATION ON MCDANIEL AND EUROPEAN RED MITES IN APPLE ORCHARDS,

Yakima County Cooperative Extension Service,

William B. Hudson, and B. P. Beirne. J Entomol Soc Brit Columbia. 67: 8-13. Illus. 1970. Identifiers: Apple-D. Control, Dislodge, European, \*Irrigation, McDaniel, Mites, Orchards, Panonychus-Ulmi, Red, Sprinkler, Tetranychus-McDanieli.

Overtree sprinkler irrigation of apple trees was effective in keeping populations of McDaniel spider mites, Tetranychus mcdanieli, below the economic

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level. Sprinkling had less effect on European red mites. Panonychus ulmi, because the females moved to the undersides of the leaves and continued egglaying during the sprinkling and because the eggs, unlike those of T. mcdanieli, were not dislodged by the sprinkling. The effectiveness may be increased by timing the sprinkling to coincide with the 1st appearance of the immature stages and by increasing the size of the droplets.--Copyright 1971, Biological Abstracts, Inc.

## EFFECT OF CERTAIN AGROMETEOROLOGICAL CONDITIONS ON CORNEAR OR-

GANOGENESIS, Maize Res. Inst., Knezha, Bulg.

N. Slavov.

Rastenievod Nauki. 7 (9): 3-11. Illus. 1970. Rus-

sian and English summaries. Identifiers: Agro, Corn-M, Ear, Humidity, Meteorological, Moisture, Organogenesis, Soil, Temperature.

The mean day and night air temperature was the determining factor in the duration of all stages. A negative curvilinear correlation existed between the duration of the stages and the mean day and the duration of the stages and the mean day and might air temperature, expressed by an exponential function. It was established that their relation was interrupted when the productive soil moisture dropped below 80 mm in the 1-m thick soil layer. Corn organogenesis proceeded under the most Corn organogeness proceeded under the most favorable conditions when the mean day and night temperature varies in the range of 20-25 C, the mean day and night relative humidity was 45-65% and the productive soil moisture in the 1-m soil layer was 150-160 mm.—Copyright 1971, Biological Abstracts, Inc. W72-02790

#### COMPARISON OF VARIOUS ROTATIONS ON SILTY, POORLY-STRUCTURED SOIL: THE IMPROVING EFFECT OF GROWING FORAGE CROPS, (IN FRENCH),

Institut National de la Recherche Agronomique, Toulouse (France). Station d'Agronomie et

For primary bibliographic entry see Field 021. W72-02797

# EFFECT OF IRRIGATION FREQUENCIES AND MULCHES ON GROWTH YIELD AND CHEMICAL COMPOSITION OF FRUITS OF BANANA

(MUSA CAVENDISHI), CV. HARICHHAL, Government Fruit Research Station, Basti (India). S. S. Teaotia, R. D. Tripathi, R. S. Tripathi, and R.

D. Singh. Hort Sci. 1 (1): 23-31. 1969.

Identifiers: Banana-M, Black, Chemical, Composi-tion, Frequencies, Fruit, Fruits, Growth, Harichhal, Hoeing, Irrigation, Mulches, Musa-Cavendishi-M-Cultivar, Paddy, Polythene, Straw, Weeding, Yield.

A trial was laid out in a split plot design with 4 frequencies of irrigation e.g., fortnightly, monthly, 6-weekly and no irrigation, in the main plots and 3 types of mulches, e.g., paddy straw, black polythene and hoeing-weeding in the sub-plots, making a total of 12 treatments, replicated 4 times. The effects of these treatments on growth, yield and fruit quality of banana cultivar 'Harichhal' were studied. Besides, their influence on fresh weed weight was also determined. Fortnightly irrigation and polythene mulch, on the whole, gave the best response.--Copyright 1971, Biological Abstracts, Inc. W72-02808

# LARGE EFFECTS OF SMALL WATER DEFICITS ON CHLOROPHYLL ACCUMULA-TION AND RIBONUCLEIC ACID SYNTHESIS IN ETIOLATED LEAVES OF JACK BEAN (CANAVALIA ENSIFORMIS (L.) DC.), California Univ., Los Angeles. Dept. of Botanical

Sciences.
Don P. Bourque.

Plant Physiol. 47 (4): 591-594. Illus. 1971. Identifiers: Accumulation, Auto, Bean-D, Canavalia-Ensiformis-D, Chlorophyll, Cotyledons, Deficits, Etiolated, Jack, Labeled, Leaves, Radiography, RNA, Small, Synthesis, Tritium, Uracil.

At 85% relative humidity etiolated jack bean leaves accumulated chlorophll rapidly with little or no lag phase in synthesis. At 50% relative humidity (measured value, 47%), the rate of chlorophyll accumulation was somewhat retarded, only half as much having accumulated per leaf after a 12-hr period as in the 85% relative humidity chamber. Subsequently, however, metabolic adaptation seemed to occur and accumulation was so rapid that after 48 hr the level of chlorophyll was 90% of that found in the 85% relative humidity chamber. When the leaves were allowed to green at 25% relative humidity, very slow chlorophyll accumulation occurred reaching only one-quarter of that found in the 85% relative humidity chamber after 12 hr. Also, little or no metabolic adaption occurred, and the amount of chlorophyll after 48 hr was only 36% of that accumulated at 85% relative humidity. In the absence of a cotyledonary food supply, greening was negligible even after 48 hr under high relative humidity conditions. In addition, 3H-uracil in-corporation into newly-synthesized RNA was markedly inhibited by the absence of cotyledons when etiolated primary leaves were allowed to green at 85% relative humidity. In contrast, 9.4% of the total radioactive uracil applied in the presence of 1 cotyledon was incorporated into RNA in this experiment.—Copyright 1971, Biological Abstracts, Inc. W72-02819

### RAINFALL USE EFFICIENCY FOR DRYLAND BARLEY WITH THREE CROP AND WATER MANAGEMENT SYSTEMS, California Agricultural Experiment Station, River-

side. R. E. Luebs, and A. E. Laag. Soil Sci Soc Amer Proc. 35 (2): 336-340. 1971. Identifiers: Annual, Barley-M, Concentration, Crop, Cropping, Dryland, Hordeum-Vulgare-M, Irrigation, Management, Rainfall, Runoff, Storage,

Three crop and water management systems for barley (Hordeum vulgare L.) were compared in a winter rainfall climate on Hanford sandy loam. These systems were annual cropping with runoff re-tention, a fallow-crop sequence with runoff retention, and induced runoff on 1/2 the area for concentration and annual cropping on the remaining half. Land slope was 2-3% and runoff was retained with dikes at 7.6-m intervals in the 1st 2 systems. Over a 3-yr period average grain yields were 1.58, 2.04, and 2.29 ton/ha with rainfall use efficiencies of 41, 29, and 31 kg/ha-cm for annual cropping, fallow-crop, and induced runoff concentration systems, respectively. The additional soil water in downslope areas of the annual and fallow-crop systems and in areas receiving reduced runoff was reflected in increased barley kernels/head and greater kernel weight. Holding runoff on the land and cropping annually increased rainfall use effi-ciency 42% over both that obtained where runoff occurred in the annual cropping system and that obtained for the entire plot area in the fallow-crop system. The efficiency of fallow for storing water in the soil was 16.7%.—Copyright 1971, Biological Abstracts, Inc. W72-02840

# THE INFLUENCE OF WATER ON PRODUCTIVITY AND QUALITATIVE PROPERTIES OF SOME MEDICINAL PLANTS, Polish Academy of Sciences, Warsaw. Section on Agricultural and Forestry Science.

Antonina Ruminska. Postepy Nauk Roln. 17 (1/2): 121-130. 1970. Identifiers: Caraway-D, Coriander-D, Medicinal, Oil, Peppermint-D, Plants, Productivity, Qualitative, Water, Yield.

A number of medicinal plants show high water requirements (peppermint, caraway), the yields of which increase several times or even several fold when adequately supplied. Other plants also react favorably to water (coriander), giving higher yields and a higher oil content especially with high applications of NPK. Oil content, is highest under optimal water conditions. Both excess and lack of cations of NPA. On content, is nignest under op-timal water conditions. Both excess and lack of water, can result in yield decline. The need to in-vestigate the physiological reaction of certain spe-cies to irrigation, and to determine the best techniques of water is indicated.—Copyright 1971, Biological Abstracts, Inc. W72-02916

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CRANBERRY GROWTH AS RELATED TO WATER LEVELS IN THE SOIL,
Department of Agriculture, Kentville (Nova Scotia). Research Station.
I. V. Hall.

an J Plant Sci. 51 (3): 237-238. Illus. 1971. Identifiers: Cranberry-D, Growth, Soil.

The plants on a high water level grew faster initially, but in the final stages of the experiment their growth was slowed greatly. Plants growing in medium water level made the greatest total shoot growth, and those growing in low water level made little growth until the final 5 wk of the experiment. The plants of the 2 cultivars 'Beckwith' and 'Pilgrim' behaved almost identically and there were no significant interactions between levels and cultivars. Plants growing in the containers with the high water level had a dense mat near the surface with no growth below the water level, the root system from the medium water level was not as thick but it extended much deeper, and the root system from the low water level was long, with a few laterals until near the water level.—Copyright 1971, Biological Abstracts, Inc. W72-02917

#### GROWTH, WATER USE, AND ENERGY BALANCE COMPARISONS BETWEEN BETWEEN ISOGENIC LINES OF BARLEY,

Department of Agriculture, Sidney, Mont.

J. Kristian Aase.

Agron J. 63 (3): 425-428. 1971.

Identifiers: Albedo, Balance, Barley-M, Chlorophyll, Energy, Growth, Hordeum-Vulgare-M, Index, Isogenic, Leaf, Lines. Barley-M,

Three barley (Hordeum vulgare L.) cultivars and their isogenic lines, with color (chlorophyll) as the variable, were tested under dryland conditions for various performance characteristics. Chlorophyll content and dry matter production were lower and growth stage development was later for the pale plants compared with their dark counterparts. Total water use was about the same for all cultivars and isogenic lines; however, water-use efficiency was higher for the dark than for the pale plants. Albedos were higher, canopy temperatures were lower, net radiation tended to be higher, and more of the energy was dissipated as sensible heat loss to the atmosphere for the pale compared with dark isogenic lines.--Copyright 1971, Biological Abstracts. Inc.

### CORN CANOPY TEMPERATURES DURING FREEZING OR NEAR-FREEZING CONDI-

Environmental Data Service, Silver Spring, Md. James J. Rahn, and D. Murray Brown. Can J Plant Sci. 51 (2): 173-175. 1971 Identifiers: Canada, Canopy, Corn-M, Damage, Freeze, Freezing, Temperatures.

Leaves in the upper portion of a corn canopy may experience temperatures slightly below 0C when shelter minima fall to 1 or 2C. Apparently leaf temperatures of -0.5 or -1.0C are not seriously damaging to the corn plant, and a shelter value of 0C, suggesting leaf temperatures of -1.5 to-3.0C, is a useful guide in determining freeze damage to corn plants

#### WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

#### Control of Water on the Surface—Group 4A

in southern Ontario. The relationship between shelter and canopy temperatures is dependent on the location of the shelter relative to the canopy, and on the general synoptic weather conditions as-sociated with the freeze potential. While some plant damage occurred in low-lying areas when shelter minima fell to 1 to 2C, widespread damage did not occur until shelter minima reached OC or lower. Minimum temperatures at grass level could be much below OC before any damage occurred... Copyright 1971, Biological Abstracts, Inc. W72-02928

# EFFECTS OF WATER STRESS ON THE ACTIVITIES OF THREE ENZYMES IN MAIZE SEEDLINGS,

Massachusetts Univ., Amherst. Dept. of Plant Soil

Science.
John M. Bardzik, H. V. Marsh, Jr., and J. R. Havis.
Plant Physiol. 47 (6): 828-831. 1971.
Identifiers: Alanine, Ammonia, Complex, Dehydro,
Enzymes, L., Lyase, Maize-M, Nad, Nitrate, Oxidase, Phenyl, Reductase, Seedlings, Stress, Water,
Zea-Mays-M.

Changes in the activities of 3 enzymes (nitrate Changes in the activities of 3 enzylines (intrace reductase, L-phenylalanine ammonia-lyase, and a dehydro-NAD oxidase complex) were measured during development of water stress in young maize (Zea mays) plants. L-Phenylalanine ammonia-lyase and nitrate reductase activities decreased markedly with water deficits of 10-20%. The activities did not reach zero at water deficits as high as 50%, but appeared to approach a new steady state. Partial to complete recovery of enzyme activity occurred 24 hr after rehydration of the stressed plants. The oxidase activity did not respond to water stress in the same manner as that of the other 2 enzymes. It is suggested that the level of enzyme activity is a consequence of an equilibrium between the rates of synthesis and degradation, and that progressive tissyndresis and degradation, and that progressive these sue dehydration reduces both the enzyme synthesis and the enzyme-inactivating systems.—Copyright 1971, Biological Abstracts, Inc. W72-02930

# DEVELOPMENTAL CHARACTERISTICS OF THE LEAF SURFACE OF SPRING WHEAT DURING THE DRY SEASON,

Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Botaniki.

L. M. Mamonov, and F. A. Polimbetova. S-Kh Biol. 5 (1): 131-132. 1970.

Identifiers: Developmental, Dry, Leaf, Season, Spring, Surface, USSR, Wheat-M.

The surface areas of the leaves and photosynthetic potentials of types of winter wheat do not currently meet the requirements for high yields. These in-dices should be larger during the period from spiking to maturation, which can be accomplished with larger upper leaves. The dry season in the Tsclinograd region often coincides with the period scinograd region often coincides with the period when development of the area of the leaves and photosynthetic potential is greatest (from tillering to spiking). To overcome this problem, types of wheat that enter this period later than the dry season must be used to overcome this deficiency. Measures must also be taken to increase photosynthetic activity.—Copyright 1971, Biological Abstracts Inc. cal Abstracts, Inc. W72-02931

# APPLICATION OF THE PRINCIPLE OF CAL-CULATED RISK OF SCHEDULING SUPPLE-MENTAL IRRIGATION: I. CONCEPTS,

Tennessee Univ., Knoxville. Dept. of Agricultural Engineering. W. H. Allen, and J. R. Lambert.

Agric Meteorol. 8 (3): 193-201. Illus. 1971. Identifiers: Calculated, Crop, Irrigation, Moisture, Principle, Production, Risk, Scheduling, Soil, Supplemental, Weather.

The concepts associated with applying the principle of calculated risk to irrigation scheduling are discussed. The basis for a general model for making daily decisions is formed by combining information relating crop production and available soil with economic data and weather forecast data within a probability framework. The required inputs for such a model are discussed with respect to origin and form necessary to make the model operational. The resulting model makes each irrigation scheduling decision an attempt toward partial optimization of resource use and resulting economic gains or losses.--Copyright 1971, Biological Abstracts, Inc. W72-02934

#### THE AGROTENSIOMETER, AN INSTRUMENT FOR MEASURING MOISTURE OF IRRIGATED SOILS,

Institutul Agronomic, Bucharest (Rumania).

V. Ionescu-Sisesti, and S. Iacobescu. Lucrasi Stiint Inst Agron 'N Balcescu' Ser A. 12: 489-506. Illus. 1969. English, French and Russian

Identifiers: Argo, Instrument, Irrigated, Measuring, Moisture, Soils, Suction, Tensiometer.

The functioning is based upon the correlation of soil suction power and moisture content. The instrument measures the soil suction power in the range of the optimum moisture for crops. It is made up of a porous vessel filled with water, hydraulically jointed to a device for measuring depressure and suction. The instrument is graded so that soil moisture may be directly read. This instrument is largely used in Romania for irrigated cropping and irrigation research.--Copyright 1971, Biological Abstracts, Inc. W72-02935

#### EXPERIMENTAL RESULTS REGARDING TIL-LAGE ON THE CHERNOZEM OF CARACAL, Ministerul Agriculturii si Silviculturii, Caracal (Rumania). Agricultural Experiment Station. V. Apostol, C. Balan, and A. Florea. Probl Agr. 21 (12): 70-78. Illus. 1969. Identifiers: Caracal, Chernozem, Corn-M, Depth, Romania, Tillage, Wheat-M.

Deep tillage increases production in poor soils fertilized with small amounts of nutrients, and on non-fertilized soils. Such tillage helps store greater water reserves in the soil, and permits a faster and more intensive loss of water in periods of high consumption and evaporation than normal tillage. Results over a 6-yr period showed a build-up in the efficiency of deep tillage for non-irrigated wheat and corn, on strongly levigated chernozem.--Copy-right 1971, Biological Abstracts, Inc.

#### 04. WATER OUANTITY MANAGEMENT AND CONTROL

#### 4A. Control of Water on the Surface

NONLINEAR RESPONSE OF A SMALL DRAINAGE BASIN MODEL, Uttar Pradesh Agricultural Univ., Naini Tal (In-

For primary bibliographic entry see Field 02E.

W72-02009

#### FLOOD PLAIN INFORMATION, WILLAMETTE RIVER AND MARYS RIVER, CORVALLIS AND PHILOMATH, OREGON.

Corps of Engineers Portland, Oreg.

Army Corps of Engineers Flood Plain Report, March 1971, 49 p, 9 fig, 34 plate, 11 tab.

Descriptors: \*Floods, \*Flood damage, \*Flood plains, \*Oregon, Regional flood, Flood forecasting, Flood control, Peak discharge.

River (Oregon), Standard project flood, Intermediate regional flood.

Flooding along the middle reach of the Willamette River basin in Benton and Linn Counties, Oregon is described to aid in solving local flood problems and described to all in solving local nood process and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections and other material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. Floods in the study area are caused primarily by intense rainfall augmented by snowmelt at a time when the soil is nearly saturated. Because of longer travel distance between the headwaters and the study area, crests on Willamette River occur 1 or 2 days later than those on Marys River. Willamette River remains above bankfull stage for as long as 9 days following a major flood, whereas Marys River recedes to within banks in 7 or 8 days. (Woodard-USGS) W72-02262

# FLOOD PLAIN INFORMATION, BUTTERNUT CREEK, DE WITT AND MANLIUS TOWNSHIPS, ONONDAGA COUNTY, N.Y. Corps of Engineers, Buffalo, N. Y.

Army Corps of Engineers Flood Plain Report, May 1971. 50 p, 28 fig, 10 plate, 12 tab.

Descriptors: \*Floods, \*Flood damage, \*Flood plains, \*New York, Regional flood, Flood forecasting, Flood control, Historic flood, Peak discharge. Identifiers: \*Floods (Onondaga County, N.Y.), Standard Project Flood, Intermediate Regional

Flooding along Butternut Creek, Onondaga County, New York is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections and other material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. All of the flood plain within the study area is sub-ject to flooding. The area which is flooded most frequently is upstream of the DeWitt railroad yard bounded by State Highway 290 to the north, Tow-path Road to the south, Bridge Street to the west, and Butternut Creek to the east. This area encompasses the majority of the commerical damage. Bridge Street forms a divide between the Butternut Creek basin and the Ley Creek basin to the west. Flood waters flow through culverts under Bridge Street and, at times, over the street, damaging residential property in the village of East Syracuse. (Woodard-USGS) W72-02263

## EFFECTIVENESS AND PERSISTENCE OF BROMACIL AND KARBUTILATE APPLIED USING FIXED- AND ROTARY-WING AIR-CRAFT, Texas A and M Univ., College Station. Dept. of

Range Science.
W. G. McCully, C. W. Robinson, and J. G.

Darroch.

Available from the National Technical Information Service, Springfield, Va., 22151 as AD-723 402 \$3.00 in paper copy, \$0.95 in microfiche. Texas A and M University, February 1971. 51 p, 11 fig, 4 tab, 27 ref, 5 append.

Descriptors: \*Herbicides, \*Plant growth regula-tors, \*Application methods, \*Surface runoff, \*Tex-as, Brush control, Aircraft, Environmental effects, Seepage, Vegetation, Sprays, Granules, Plant growth, Soil water movement. Identifiers: Bromacil, Karbutilate.

#### Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4A-Control of Water on the Surface

Bromacil and karbutilate granules and sprays were aerially applied to a brush-grass vegetation in south-central Texas at rates of 10 and 20 lb/A. Equivalent control of all vegetation was obtained initially from applications made in either October or April, but April treatment maintained control for two growing seasons. Granules were more effective than spray treatments. Annuals and two species of Quercus were more sensitive to karbutilate than to bromacil. Deep-rooted perennial herbaceous plants were controlled better with the higher rate, and grasses were more resistant than broadleaf herbs. Perennial herbaceous plants and woody vines re-appeared in treated areas before annuals. Residues were determined by bioassay throughout the surface 2-ft of soil profile, and may have occurred deeper in the porous soil media. Herbicide residues, also moved away from the target area in surface runoff, and possibly in shallow groundwater which surfaced as seeps. Bromacil was more susceptible than karbutilate to movement from the point of application. (Woodard-USGS) W72-02267

ANALYSIS OF ALTERNATIVE PROCEDURES FOR THE EVALUATION OF AGRICULTURAL FLOOD CONTROL BENEFITS, VOLUME II, Economic Research Service, Washington, D. C. For primary bibliographic entry see Field 06B. W72-02269

AGRICULTURAL FLOOD CONTROL BENEFITS AND LAND VALUES. Corps of Engineers, Alexandria, Va. Inst. for Water Resources. For primary bibliographic entry see Field 06B. W72-02270

SELECTIVE WITHDRAWAL CHARAC-TERISTICS OF WEIRS; HYDRAULIC LABORA-TORY INVESTIGATION, Army Engineer Waterways Experiment Station,

Vicksburg, Miss.
For primary bibliographic entry see Field 08B.

For primary bibliographic entry see Field 08B. W72-02271

EVALUATION OF EFFECT OF IMPOUND-MENT ON WATER QUALITY IN CHENEY RESERVOIR, Colorado State Univ., Fort Collins.

Colorado State Univ., Fort Collins. For primary bibliographic entry see Field 05C. W72-02274

SCOUR OF SIMULATED GULF COAST SAND BEACHES DUE TO WAVE ACTION IN FRONT OF SEA WALLS AND DUNE BARRIERS, Texas A and M Univ., College Station. Coastal and

Ocean Engineering Div.
For primary bibliographic entry see Field 02J.
W72-02279

BIOGEOCHEMISTRY OF DELTA-MENDOTA CANAL, CENTRAL VALLEY PROJECT, CALIFORNIA,

Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics. For primary bibliographic entry see Field 02J.

W72-02298

A COMPARATIVE STUDY OF STANDING CROPS AND OF PHOSPHORUS AND NITROGEN CONTENTS OF FOUR MACROPHYTE STREAM COMMUNITIES, Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.

For primary bibliographic entry see Field 05C. W72-02307

SPECIAL FLOOD HAZARD REPORT, GREATER ANCHORAGE AREA, CHESTER, CAMPBELL, FISH AND SHIP CREEKS. Corps of Engineers, Anchorage, Alaska.

Descriptors: \*Floods, \*Flood plains, \*Flood forecasting, \*Alaska, Flood control, Flood damage, Peak discharge.
Identifiers: \*Floods (Anchorage, Alaska), Intermediate Regional Flood, Standard Project Flood.

The maps and profiles in this supplemental flood-plain report of Greater Anchorage, Alaska update and improve the same material contained in the Chester and Campbell Creek reports of June 1968. In addition both Fish and Ship Creek hazard area maps and profiles are included in order to provide maximum available coverage to the Anchorage area. Every effort has been made to include all new subdivisions, stream changes, roads and streets, culverts or bridges and all other changes having influence on the flood potential. However, except for some new cross sectional surveying work it was necessary to use the same maps as shown in the 1968 reports. All information contained in the original reports has not changed except as noted. Urbanization and continued uncontrolled misuse of the streams and their flood plains has resulted in increased hazard in some areas as well as increasing the glaciation potential throughout the area. (Woodard-USGS)

FLOOD PLAIN INFORMATION, CUYAHOGA RIVER, AKRON TO SUMMIT-PORTAGE COUNTY LINE, OHIO. Corps of Engineers, Buffalo, N.Y.

Army Corps of Engineers Flood Plain Report, May 1971. 53 p, 35 fig, 13 plate, 8 tab.

Descriptors: \*Floods, \*Flood damage, \*Flood plains, Ohio, Regional flood, Flood forecasting, Flood control, Design flood, Peak discharge, Historic flood

Identifiers: \*Cuyahoga River (Ohio), Standard Project Flood, Intermediate Regional Flood.

Flooding along the Cuyahoga River from Akron-Peninsula Road to the Summit-Portage County line, Ohio is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections and other material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights, and other technical data. The greatest known flood recorded on the Cuyahoga River at the Akron-Peninsula Road bridge had an estimated peak discharge of 6,500 cfs. For the same site, the Intermediate Regional Flood (100 years) is estimated at 5,820 cfs and the Standard Project Flood at 41,100 cfs. (Woodard-USGS)

TRANSFORMATION OF SEDIMENT LOAD UNDER INFLUENCE OF RESERVOIRS (PREOBRAZOVANIYA TVERDOGO STOKA POD VLIYANIYEM VODOKHRANILISHCH), 10M.I., L'VOVICH, AND Akademiya Nauk SSSR Moscow Institut

Akademiya Nauk SSSR, Moscow. Institut Geografii.

M. I. L'vovich, and Ye. I. Kupriyanova.
Akademiya Nauk SSSR Izvestiya, Seriya
Geograficheskaya, No 4, p 37-47, July-August
1971. 4 tab, 9 ref.

Descriptors: \*Sediment load, \*Sediment discharge, \*Sediment transport, \*Reservoir construction, \*Reservoir operation, Turbidity, Suspension, Suspended load, Discharge (Water), Runoff, Surface runoff, Runoff coefficient, Soil erosion. Identifiers: \*USSR, Volga River, Don River, Rybinsk Reservoir, Kuybyshev Reservoir, Volgograd Reservoir, Tsimlyansk Reservoir.

The amount of sediments transported by rivers changes in time under the influence of natural factors and the activities of man. Two principal factors are responsible for the transformation of sediment load: (1) agricultural, water management and forest reclamation measures, which alter the magnitude and regime of surface runoff and modify the degree of susceptibility of the soil to erosion; and (2) construction of reservoirs, which accumulate sediments and change the water regime of the river in reaches below the reservoirs. Transformations of sediment load under the influence of these factors were examined for a number of reservoirs recently constructed in the USSR: the Rybinsk, Kuybyshev and Volgograd Reservoirs on the Volga and the Tsimlyansk Reservoir on the Don. Prior to construction activity, sediment discharge from the Volga into the Caspian Sea was estimated to be 25.2 million metric tons a year. Present annual sediment discharge into the Caspian Sea is estimated to be 6-7 million metric tons. The average annual water discharge of the Volga today is approximately 18 cu km less than in the past. This decrease is associated with (1) evaporation from the surface of recently constructed reservoirs; (2) withdrawal of water in the Volga River basin to meet water supply and irrigation demands; and (3) decrease in surface runoff resulting from the application of more improved agricultural practices. Under the influence of the Tsimlyansk Reservoir, annual suspended sediment discharge of the Don River decreased by 2 million metric tons or 1.7 fold. The total sediment discharge of the Don River decreased by 2 million metric tons of the Pon River decreased by 2 million metric tons of the reservoir was reduced 35-40%. (Josefson-USGS) W72-02310

EFFECTIVENESS OF POSITIVE MEASURES ON THE WATER BALANCE OF AGRICUL-TURAL LANDS (EFFEKTIVNOST'AKTIVNOGO VOZOEYSTVIYA NA VODNYY BALANS SEL'-SKOKHOZYGYST VENNYKH UGODI),

Akademiya Nauk SSSR, Moscow. Institut Geografii.

A. M. Grin, T. A. Saveliyeva, and Ye. P.

Chernyshev. Nauk SSSR Izvestiya, Seriya Geograficheskaya, No 4, p 59-66, July-August 1971. 10 tab, 7 ref.

Descriptors: \*Land management, \*Soil management, \*Farm management, \*Forest management, \*Snow management, Water balance, Water storage, Runoff, Soil moisture, Infiltration, Surface runoff, Subsurface runoff, Snowmelt, Cultivation, Plant growth, Barley, Evapotranspiration, Shelterbelts, Fertilizers.

Identifiers: \*USSR, Kursk Oblast, Kursk State Agricultural Experimental Station, Central Chernozem Area, Afforestation.

Studies are being conducted by the Kursk Experimental Field Base of the Institute of Geography, Academy of Sciences, USSR and by the Kursk State Agricultural Experimental Station to determine the effectiveness of various agricultural and forest reclamation measures on the structure of the water balance of agricultural lands. In the Central Chernozem Area the purpose of the measures is threefold: (1) to increase water storage in snow as a basic source of supplementing soil moisture resources during the first and most critical period of plant growth; (2) to reduce surface and subsurface runoff from fields and to create favorable conditions for the infiltration of water into the soil; and (3) to increase the effectiveness of the use of soil moisture during a growing season. Observations are being conducted under conditions of a high natural soil fertility, favorable hydrometeorological conditions and an advanced agricultural technology peculiar to the Kursk Agricultural Experimental Station. (Josefson-USGS)

REGULATION OF STREAMFLOW (REGULIROVANIYE RECHNOGO STOKA),

N. A. Kartvelishvili. Gidrometeoizdat, Leningrad, 1970. 220 p.

#### WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

Control of Water on the Surface—Group 4A

Descriptors: \*Regulation, \*Streamflow, \*Water management (Applied), Statistical methods, Mathematical studies, Stochastic processes, Monte Mathematical studies, Stochastic processes, Monte Carlo method, Dynamic programming, Optimiza-tion, Probability, Digital computers, Water con-sumption, Water supply, Water yield, Water loss, Water level fluctuations, Runoff, Reservoirs, Hydroelectric plants. Identifiers: \*USSR.

This monograph consisting of 8 chapters discusses the theory of streamflow regulation under the present-day conditions of multiple-use management of natural waters. Special attention is paid to the problem of water management and to the quantitative characteristics of its components. The application of statistical methods and computer technology to the solution of problems of streamflow regulation and to optimum natural-resource use of a hydroelectric power network is viewed against the background of an emerging shift in man's attitude from a concept of single-use to multiple-use management. The text is designed to serve hydrologists, consulting engineers, and technicians engaged in the operation of water management structures. (Josefson-USGS) W72-02319

HYDROLOGY OF HORSESHOE LAKE, AR-KANSAS.

Geological Survey, Little Rock, Ark. A. G. Lamonds.

Geological Survey Open-file Report, 1971. 77 p, 14 fig, 9 tab, 14 ref.

Descriptors: \*Lakes, \*Recreation, \*Arkansas, \*Water pollution effects, \*Surface-groundwater relationships, Lake stages, Reservoir evaporation, Soil water movement, Water balance, Analog models, Hydrologic budget, Storm runoff, Water wells, Mississippi River, Water quality, Pesticides, Herbicides, Seepage. Identifiers: \*Horseshoe Lake (Ark).

The hydrologic system associated with Horseshoe Lake in south Crittenden County, Arkansas is described. Adjacent to the Mississippi River, the oxbow lake receives runoff from a small drainage area and has no surface outflow most of the year. Rainfall on the lake averages 49 in/yr which, inflow from runoff, normally exceeds losses from seepage and evaporation. In summer and fall, seepage and evaporation losses exceed rainfall and runoff inflow and seasonal lake level declines of 2 to 3 ft are common. During severe droughts the level has been 4 ft below normal seasonal minimum level. These low levels severely affect the recreational uses of the lake. Constant lake level can be maintained by supplementary ground or surface waters. Local drainage, however, contains un-lesirable pesticides, herbicides, and plant utrients, and is insufficient in volume. Water from he Mississippi River can be used but it is baceriologically undesirable. Water from the alluvial quifer contains troublesome iron but is essentially ee of pesticides, herbicides, and coliform bacria. An analog model study indicates lake level in be kept at near normal spring level by adding ater at the rate of 10,000 to 11,000 gallons per inute. The model also shows that except for wells the southeast end of the lake, wells located thin half a mile of the lake would derive more an 50% of their yield from the lake after 90 days operation. (Lang-USGS) 72-02321

HE DISTRIBUTION AND CONTROL OF AACROPHYTE BIOMASS IN LAKE WINGRA, Wisconsin Univ., Madison. Water Resources

Center. S. A. Nichols.

Available from the National Technical Information Available from the National Technical monitoring Service as PB-205 152, \$3.00 in paper copy, \$0.95 in microfiche. Wisconsin Water Resources Center, Madison, Final Completion Report, 1971. 111, 24 fig. 11 tab, 65 ref, 1 append. OWRR B-019-WiS Descriptors: \*Lakes, \*Biomass, \*Ecological distribution, \*Aquatic weed control, \*Aquatic life, Wisconsin. Identifiers: \*Macrophyte, \*Myriophyllum spicatum, \*Harvesting, Growth curves, Summer, Lake Wingra (Wis), Madison (Wis).

Accelerated plant growth has created management problems for the lakes in the Madison, Wisconsin area. The rank growth of an Eurasian invader, Myriophyllum spicatum, has greatly restricted lake usage and has nearly eliminated the native flora. A study into the basic ecology of aquatic macrophyte plants was undertaken so that ecologically sound methods of preferential treatment could be recommended that will encourage beneficial species and discourage undesirable species. The objective of the research was to study the distribution of aquatic plants in Lake Wingra and then use the information to recommend management procedures. More specifically, the temporal and spatial destruction of biomass and the relationships of species to one another were studied. The growth patterns of the major species were used to describe the temporal destruction of biomass. Implied in the spatial distribution was a study of environmental factors which cause observable differences of biomass in the lake at any one time. Plant biomass was sampled on a stratified random basis, at biweekly intervals, throughout the summer growing season. The depth of water; texture, percent organic matter, and depth of detritus of bottom substrates; and and depth or detritus of bottom substrates; and light penetration were thought to be critical factors influencing spatial distribution. Recommendations include two harvests per year, working from shallow to deep water, beginning about June 1. W72-02350

SMALL WATERSHED AND DRAINAGE LAWS

OF NORTH CAROLINA, North Carolina Univ., Chapel Hill. Water Resources Research Inst. For primary bibliographic entry see Field 06E. W72-02353

EXPERIMENTAL INVESTIGATION OF HYDRAULIC TRANSIENTS IN RIVER-RESE-

RVOIR SYSTEMS - PHASE II,
Tennessee Univ., Knoxville. Dept. of Civil Engineering and Engineering Mechanics. For primary bibliographic entry see Field 02E. W72-02434

HYGIENIC CHARACTERISTICS OF THE TREATMENT OF IRRIGATION CANALS WITH NEW CHLORINATED HERBICIDES, (IN RUS-

V. M. Orlovskii, D. I. Golovan', and G. D. Kudzina. Gig Sanit. 35 (11): 91-92. Illus. 1970. Identifiers: Canals, Chlorinated, Herbicides, Hygienic, Irrigation, Treatment.

Field tests of weed removal from irrigation canals with 50kg/ha applications of 2-KF herbicide (30% water solution of dimethylamine salts of polychlorobenzoic acids) or 40 kg/ha applications of dianate produced no significant changes in water quality. Such treatment was effective against all perennial weeds excepting reeds, and leaves residual amounts of herbicide in the canal waters of 5 and 15mg/l, respectively, which is well below maximum allowable concentrations.—Copyright 1971, Biological Abstracts, Inc.

MAIN RESULTS OF EXPERIMENTAL WORK ON RAISING PLANTING STOCK FOR AF-FORESTATION OF FORMERLY SUBMERGED SOIL OF THE LAKE SEVAN) (IN RUSSIAN), V. M. Muradyan

Sb Tr Arm Nauch-Issled Les Opyt Sta. 5. 127-132.

Identifiers: Birch-D, Fertilizers, Forestation, Lake, Larch-G, Pine-G, Planting, Quercus-Macranthera-D, Raising, Sevan, Soil, Stock, Submerged, USSR, Willow-D, Work. Pine, larch, birch and Quercus macranthera were the most valuable forest trees. Seedlings of pine and larch were raised in deep beds, the long side running from east to west. Fertilizers increased the germination capacity of pine and improved the growth of seedlings, particularly with crop rotation where, with 2 weedings and without watering, the results were better than in the experimental nursery with 7 weedings and 5 waterings. The best method of afforestation of bottom sediments of the lake Seven was planting in 25-30 cm trenches with eastwest orientation with the furrow slice inversion southward in the year of the emergence of the ground from under the water. Survival in this cas was 85%; in the case of planting in holes of 20 x 30 cm it was 54-48%. The saline bottom sediment should be plowed and heaped so that furrow crests 40 cm high are created and sowing or planting should be effected on the tops (survival 75% as against 12.5% in the control without crests. The best restoration of willow stands is to cut alternate rows and to plant 2-yr-old stock in trenches with 1971, Biological Abstracts, Inc.
W72-02563

SOME METHODS FOR IMPROVING THE SUR-VIVAL RATE OF CULTURES ON THE SOUTHERN SLOPES OF NORTHERN AR-MENIA, (IN RUSSIAN), G. M. Akhinyan.

Sb Tr Arm Nauch-Issled Les Opyt Sta. 5. 93-103. 1968

Identifiers: Almond-D, Armenia, Bitter, Cultures, Elaeagnus-Angustifolia-D, Fall, Methods, Mulching, Northern, Oak-D, Oleaster-D, Oriental, Pine-G, Planting, Potassium, Quercus-Macranthera-D, Rate, Silicate, Slopes, Southern, Survival USSR

Experiments aimed at increasing the rate of survival of cultures used to bind the shallow, rocky soils of the dry eroded southern slopes of Northern Armedia were carried out with various water absorbing substances and mulches, peat pots, peat, and clod methods of planting. Mulching with K metasilicate, capable of condensing about 80% of the air moisture, sawdust or stones, increased culture survival rate by 32%-38%. Best results were achieved with K metasilicate, poorest with sawdust. Peat pots made from a mixture of peat, fertile soil and various fertilizers contributed greatly to the survival rate of seedlings of oleaster (Elaeagnus angustifolia), bitter almond, large-anthered oak (Quercus macranthera) and oriental oak. Peat strewn over the culture area gave poor results. The technique used for ball planting of pine seedlings is described.--Copyright 1971, Biological Abstracts,

DIAGNOSTICS AND THE ECONOMIC GROUP-ING OF FOREST TYPES OF THE NORTHERN SLOPE OF GREATER CAUCASUS, (IN RUS-SIAN), B. F. Ostapenko.

Tr Khar'kov Sel'skokhoz Inst. 72 (109): 111-257.

Identifiers: Aspen-D, Beech-D, Birch-D, Caucasus, Diagnostics, Distribution, Economic, Fir-G, Forest, Grouping, Northern, Oak-D, Pine-G, Regenera-tion, Slope, Soil, Spruce-G, Types, USSR.

Oak-, beech-, fir-, spruce- and pine forest types were defined as well as birch and other forest types at the upper forest limit, and aspen and other forest types of the river floodplains. The characteristics of forest types include the distribution of types, their geographic and topographic position, soils, inven-tory characteristics of stands, regeneration, the development and the characteristics of the lower layers. Recommendations are given on the manage-ment trend and on measures in connection with economic objectives .-- Copyright 1971, Biological Abstracts, Inc.

#### Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4A—Control of Water on the Surface

STUDY OF NATURAL REGENERATION OF TREE AND SHRUB SPECIES ON AREAS PERIODICALLY INUDATED BY THE RYBINSK RESERVOIR, (IN RUSSIAN), K. A. Kudinov, and I. G. Igtisamov. Tr Darvinskogo Gos Zap 9 p. 104-122. 1968. Identifiers: Betula-Pubescens-D, Betula-Verrucosa-D, Birch-D, Inundated, Natural, Periodically, Pine-G. Reservation, Reservoir, Rybinsk, Saliv-Cosa-D, Birch-D, indinducel, Natural, Periodically Pine-G, Regeneration, Reservoir, Rybinsk, Salix-Acutifolia-D, Salix-Caprea-D, Salix-Cinerea-D, Salix-Nigricans-D, Salix-Pentandra-D, Salix-Phyl-icifolia-D, Salix-Triandra-D, Shrub, Species, Tree, USSR, Willow-D.

Regeneration occurs mainly from seed transported by water; the seedlings are thus arranged in strips along the water line. Salix cinerea, S. nigricans, S. phylicifolia, S. triandra, S. pentandra, S. acutifolia, S. caprea seedlings predominate. Betula verrucosa and B. pubescens seedlings occur frequently; those and a processes seedings occur requestly, those of pine rarely. There are considerably less seedlings on sand shallows, only the willow seedlings grow. The shallows with humus and the slopes subject to inundation are usually covered with herbaceous vegetation with many birch and willow seedlings. Regulation of the Reservoir level conditions may stimulate considerably the process of the establish-ment of seedlings and of the formation of young stands of tree- and shrub species.--Copyright 1971, Biological Abstracts. Inc.

THE UNDERGROUND MASS OF MEADOW VEGETATION IN THE FLOOD PLAIN OF THE OKA RIVER AND THE EFFECT OF FERTILIZERS, (IN RUSSIAN),

A. P. Demin. Byull Mosk Obshchest Ispyt Prir Otd Biol. 75 (6):

Byuli Moss Consented Byyr Fill Old Biol. 75 (8): 79-85. 1970 (English summary). Identifiers: Fertilizers, Flood, Mass, Meadow, Nitrogen, Oka, Phosphorus, Plain, Potassium, River, Underground, Vegetation.

The underground mass of vegetation was studied in 2 parts of the flood plain differing in soil moisture. In the control plots the weight of underground organs (to a depth of 1 m was 1177 g/m sq under more xerophytic conditions and 1425.7 g/m sq in a moist meadow. The live fraction accounted for 71.3% and 63.5% respectively. In the experimental plots with application of NPK the mass of underground plant organs increased up to 1508.6 g/m sq in the dry meadow and to 2055.5 g/m sq in the moist meadow. The live fractions were 58.2% and 62.6% respectively.—Copyright 1971, Biological Abstracts, Inc. W72-02574

RELATIONSHIPS BETWEEN DERIVED VEGETATION GRADIENTS AND MEASURED SASKATCHEWAN WETLANDS,
University Coll. of Rhodesia, Salisbury. Div. of
Biological Sciences.
B. H. Walker, and C. F. Wehrhahn.

Ecology. 52 (1): 85-95. Illus. 1971.

Canada, Components, Derived, Disturbance, Environmental, Gradients, Measured, Nutrients, Principal, Relationships, Salinity, Saskatchewan, Varia-bles, Vegetation, Wetlands.

Thirty-four relatively undisturbed stands of vegetation in shallow marsh, non to slightly saline wetlands in south-central Saskatchewan were examined with respect to environmental influence on species distribution. Four environmental gradients account for the bulk of variation in the vegetation. They are, in decreasing order of importance, disturbance (despite the fact that all stands chosen are relatively undisturbed), available nutrients, water regime, and salinity. The greatest variation in the data from these stands as a whole is in their salinity, but this is not reflected in the vegetation. The correlation between water regime and available nutrients is negative. A number of other factors show minor correlations with the vegetation and with each other. The method of application of principal components analysis used in this study was a valuable aid in the interpretation of the data. It provides estimates of the proportions of the varia vides estimates of the proportions of the variance associated with each principal component and the total variation in the vegetation data that can be assigned to variation in the environmental measurements.—Copyright 1971, Biological Abstracts, Inc. W72-02579

FORESTS OF SMALL STREAM BOTTOMS IN THE COASTAL PLAIN OF SOUTHWESTERN

THE COASTAL PLAIN OF SOUTHWESTERN ALABAMA,
Hampden-Sydney Coll., Va. Dept. of Biology.
S. R. Gemborys, and Earl J. Hodgkins.
Ecology. 52 (1): 70-84. Illus. Maps. 1971.
Identifiers: Alabama, Bottoms, Coastal, Cornus-Florida-D, Forests, Liquidambar-Styraciflua-D, Liriodendron-Tulipifera-D, Magnolia-Virginiana-D, Moisture, Nyssa-Sylvatica-D, Ordination, pH, Pinus-Ellustris-G, Plain, Quercus-Nigra-D, Small, Soil, Southwestern, Stream.

Overstory and understory data were collected from 49 forest stands in 27 small stream bottoms in the Gulf Coastal Plain region of southwestern Alabama. The stands were arranged in a singledimensioned ordination on the basis of the portance values of the persistent species in the portance values of the persistent species in the over-stories. Leading dominant species, from the 'dry' end to the 'wet' end of the ordination gradient, were Cornus florida, Pinus palustris, Quercus nigra, Liquidambar styraciflua, Nysas sylvatica var. sylvatica, Magnolia virginiana, and N. sylvatica var. biflora. Two important seral species, most prominent at the middle of the ordination gradient and of relatively little importance at either end, were Pinus elliottii and Liriodendron tulipifera. The stand position on the ordination gradient, referred to as the moisture-regime index, was significantly related to water-table depth, soilsurface gradient, and soil pH at 63.5 cm. Failure to obtain significant relationship with other soil varia-bles was attributed to the high frequency of fresh soil deposition in the small stream bottoms. As a check on the ordination analysis, species-presence data were used to construct a species-correlation diagram. When species moisture-regime numbers from the ordination analysis were inserted in this diagram, good agreement was revealed in the results of the 2 independent analyses.--Copyright 1971, Biological Abstracts, Inc. W72-02580

APPENDIX F - FLOW-STORAGE RELATION-SHIPS AND THE COST OF FLOW,

New Mexico Univ., Albuquerque. For primary bibliographic entry see Field 06B. W72-02601

CHAPTER IX - THE 'SUPPLY' OF WATER AND

COSTS OF FLOW,
New Mexico Univ., Albuquerque.
N. Wollman, and G. W. Bonem.
In: The Outlook for Water, The Johns Hopkins
Press, Baltimore, 1971, p 96-104. 7 tab, 9 ref.

Descriptors: \*Water supply, \*Costs, \*Flow, \*Flow control, \*Storage, \*Water storage, Storage capacity, Marginal costs, Precipitation (Atmospheric). Identifiers: \*Costs of flow, Marginal cost constraint, Maximum physical regulatory storage capacity, Maximum flow, Biotic characteristics.

The amount of storage required for a specified regulated flow is dependent on the natural history of a region, for example: (1) the amount of precipitation and its chronological variation, (2) precipitation and its emotological variation, (3) geologic and geographic characteristics, and (3) biotic characteristics. These three factors are interrelated and can be manipulated by man. The seven tables in this chapter examine aspects of water supply and costs of flow. Some of the aspects considered by the tables are: (1) differences among maximum physical regulatory storage capacities as given in Committee Print No. 32; in Lof and Hardison ('Storage Requirements for Water in the

United States'); and in this study, and (2) the effects of introducing a marginal cost constraint on maximum flow and the costs of flow. (Strachan-Chicago) W72-02609

PHYSICOCHEMICAL AND PEDOGENETIC STUDY OF A COMPLEX PROFILE SITUATED ON GUADALQUIVIR BASIN AT SAN PABLO (SEVELLE) (IN SPANISH), Centro de Edafologia y Biologia Aplicada Cuarto, Saughla (Saugha)

Sevelle (Spain). N. Bellinfante, G. Paneque, and L. Clemente. An Edafol Agrobiol. 29 (7/8): 463-475. Illus. 1970.

An Educid Agrobiol. 29 (7/6): 463-473. Illus. 1970. English summary. Identifiers: Basin, Complex, Erosion, Genetic, Guadalquivir, Olive-D, Pedo, Physicochemical, Profile, San-Pablo, Seville, Situated, Spain, \*Vegetation.

The geomorphic and climatic conditions, as well as the vegetation of the area are pointed out. Three cycles are recognized; the earliest and deepest materials are similar to a red soil sediment, III C, at more than 140 cm. After erosion and accumulation of fluvial sediments, a well-developed pseudogley II Bg must have formed, permitting the later develop-ment of a xerophytic Mediterranean woodland ment of a xerophytic Mediterranean woodland vegetation with the climate changing towards greater dryness. The disappearance of the vegetation led to erosion and more recently to accumulation. At present there are olive trees on brown soil which has characteristics of leaching and hydromorphism superimposed on the earlier sediments.--Copyright 1971, Biological Abstracts, Inc. W72-02623

THE EFFECT OF LAKE REGULATION ON POPULATIONS OF CESTODE PARASITES OF SWEDISH WHITEFISH COREGONUS,

Lund Univ. (Sweden). Dept. of Animal Ecology.

Oikos. 22 (1): 74-83. Illus. Maps.. Russian summa-

ry.
Identifiers: Cestode, Coregonus, Coregonus-Nasus,
Coregonus-Oxyrhynchus,
Coregonus-Peled, Identifiers: Cestode, Coregonus, Coregonus-Nasus, Coregonus-Poyrhynchus, Coregonus-Peled, Coregonus-Pidschian, Cyathocephalus-Truncatus, Diet, Gammarus, Lake, Parasites, Plankton, Popu-lations, Regulation, Swedish, Triaenophorus-Cras-sus, Whitefish.

The occurrence of Triaenophorus crassus and Cyathocephalus truncatus (Cestoda) in whitefish Cyalnocephains truncaus (Cestoday) in Winterins Coregonus was compared in non-regulated and regulated lakes. In non-regulated lakes, Coregonus peled and C. oxyrhynchus with a high number of gillrakers and a high frequency of plankton in the diet were most heavily infested. In regulated lake differences between Coregonus spp. were absent or small. C. pidschian and C. nasus with a low number of gillrakers feed on plankton to a much higher extent in regulated lakes and become more heavily infested. In populations with low infestation no correlation was found between frequency of T. crassus and age of fish, but in populations with high infestation such a correlation was established (up to 7 yr old fish). Infestation of T. crassus did not affect the ratio weight: length of the fish. C. truncatus was absent from all regulated lakes, its intermediate host Gammarus being highly sensitive to changes provoked by the regulation.—Copyright 1971, Biological Abstracts, Inc. Coregonus was compared in non-regulated and

MONITORING ECOLOGICAL CONDITIONS ASSOCIATED WITH WIDE-SCALE APPLICA-TIONS OF DMA, 2,4-D TO AQUATIC EN-VIRONMENTS,

Environmental Research and Development. For primary bibliographic entry see Field 05C. W72-02720

REFORESTATION IN THE BRANCH RIVER CATCHMENT, New Zealand Forestry Service, Rotorua.

#### WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

#### Control of Water on the Surface—Group 4A

I I Slow NZ J Forest. 15 (2): 142-149. Illus. Map. 1970. Identifiers: Branch, Catchment, Control, Erosion, Forestation, New-Zealand, Re, River.

Exotic trees are being established in an attempt to provide seed sources for the natural reforestation of eroding mountain land. In the 4-yr period 1965-1968, group planting, hand sowing, and aerial seeding were carried out within a gross area of nearly 13,600 acres. The work and the techniques used are described and a preliminary account of results achieved so far is given.—Copyright 1971, Biological Abstracts, Inc. W72-02733

PRESENT AND FUTURE USE HYDROMETEOROLOGICAL DATA WATERSHED PROJECT PLANNING, Soil Conservation Service, Casper, Wyo. C. H. Walker.

In: Proceedings of Hydrology Seminar, University of Wyoming, May 20-21, 1971; Laramie, Wyoming University Water Resources Research Institute Report, p 107-129, 1971. 8 fig, 6 tab, 4 ref, append.

Descriptors: \*Water resources development, \*Hydrologic data, \*Project planning, \*Meteorological data, \*Wyoming, Water supply, Water demand, Watershed management, Data collections, Streamflow, Runoff, Network design.

Hydrometeorological data are used as a basis for estimating regional resource development and project needs for early action and long-range planning. Where there is a streamflow gaging station at or near a proposed structural site, the published data is used in planning the development of water resources. Since few reservoirs on small watersheds provide carryover storage, a frequency analysis of annual values of yield and peak flows are used as the basis for reservoir design. When there is no streamflow record near a proposed site, but there are records on nearby streams with similar watershed properties, some regional analysis may be transposed. This may be done by relating streamflow to one or more commonly measurable features of the watershed such as drainage area, average elevation, stream length, stream watershed, average slope, aspect and other charac-teristics in simple or multiple regression analysis. The real area of change in methodology is in the area of computer simulation models. Several special purpose simulation programs for watershed and river basin planning are being used in Wyoming studies. Someday there will be accurate computer models for all the river basins in the United States. (Woodard-USGS)

MANGATU: A PRODUCTION FOREST WITH MAJOR PROTECTION VALUE, New Zealand Forestry Service, Rotorua.

P. F. Olsen.

NZJ Forest. 15 (2): 169-183. Illus. 1970. Identifiers: Control, Debris, Deposition, Flood, Forest, Forestation, Mangatu, New-Zealand, Production, Protection, Rates, Techniques.

The geology, geomorphology and recent history of deforestation are briefly reviewed and the coincidence of recent increase in flood deposition rates and deforestation is noted. Reforestation of part of the Waipaoa head waters and the debris control techniques are described. A theoretical basis for these results is postulated and the conclusions in terms of future forest practice derived.--Copyright 1971, Biological Abstracts, Inc. W72-02791

MODEL STUDY OF GALVESTON HARBOR ENTRANCE, TEXAS. HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 08B. W72-02816

DEVELOPMENT AND MAINTENANCE OF NAVIGATION CHANNEL, ARKANSAS RIVER, ARKANSAS AND OKLAHOMA. HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 08A. 4W72-02821

NAVIGATION CONDITIONS AT PIKE ISLAND LOCKS AND DAM, OHIO RIVER: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 08B. W72-02824

MARTIN PENA CHANNEL IMPROVEMENT AND DEVELOPMENT STUDY. San Juan City Demonstration Agency, Puerto Rico.

Available from the National Technical Information Service as PB-201 643, \$3.00 in paper copy, \$0.95 in microfiche. HUD grant report, Aug 70, 138p.

Descriptors: \*Channel improvement, \*Puerto Rico, \*Urbanization, \*City planning, Land use, Water pollution, Abatement, Industrial wastes, Sewage, Bridges, Soil properties. Identifiers: \*Channel stabilization, Martin Pena

Channel

The San Juan City Demonstration Agency is conducting a coordinated two-part study of a model Neighborhood Area (MNA) and its environs. One part of the study - the Model Neighborhood Area Land Use and Development Plan - provides guidelines for the physical development of the entire area. The other part, presented in this report, consisted of an investigation of the condition of the Martin Pena Channel (which bisects the study area) and provides recommendations for improve-ments. This channel, in the heart of growing San Juan, is degraded to such an extent that it h sumed the characteritics of an open sewer. At the same time, it represents a potential asset to the MNA and the rest of the city. The recommenda-tions contained herein provide a basis for the City Demostration Agency to promote programs for pollution abatement and development of the fluvial flood lands adjacent to the channel for housing, commercial and recreational facilities. W72-02825

PROJECT TO PLAN FOR ORDERLY DEVELOPMENT OF ARKANSAS-VERDIGRIS WATERWAY AREA. VOLUME II: COMPREHENSIVE REPORT.

Frontiers of Science Foundation of Oklahoma, Frontiers of Science Foundation of Oklah Inc., Oklahoma City. For primary bibliographic entry see Field 06B. W72-02828

NAVIGATION CONDITIONS AT LOCK AND DAM NO. 9, ARKANSAS RIVER: HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B. W72-02831

CLASSIFICATION OF CHANNEL LINKS IN

STREAM NETWORKS, Cold Regions Research and Engineering Lab., Hanover, N. H.

S. J. Mock. Water Resources Research, Vol 7, No 6, p1558-1566, December 1971. 3 fig, 7 tab, 6 ref. DA task 4A062112A89401.

Descriptors: \*Drainage patterns (Geologic), \*Drainage density, Tributaries, Geomorphology, Channel morphology, Statistics, Mathematical studies, Topography. Identifiers: \*Topology, Stream link analysis.

Differences in the length properties and occur-Differences in the length properties and occur-rence frequencies among types of channel links occur in natural stream networks. Types of channel links are: (1) source links, (2) tributary source links, (3) bifurcating links, (4) tributary bifurcating links, (5) cis-trans links, and (6) tributary links. The topologically random model of channel net-works provides the basis for a series of equations defining the probabilists of coursence of soak link works provides the basis for a series of equations defining the probability of occurrence of each link type in a topologically random population of networks of any specified magnitude. Examination of interior link lengths from 12 stream networks supports the hypothesis that the interior link types defined here differ in their length properties. (K-napp-USGS)
W72-02862

CORRELOGRAM ANALYSIS REVISITED.

Thomas J. Watson Research Center, Yorktown Heights, N. Y. J. T. Wallis, and N. C. Matalas.

Water Resources Research, Vol 7, No 6, p 1448-1459, December 1971. 18 fig, 3 tab, 12 ref.

Descriptors: \*Streamflow forecasting, \*Statistics, \*Correlation analysis, \*Variability, Markov processes, Stochastic processes, Regression analy-

Identifiers: Correlogram analysis.

Consideration of the Hurst coefficient h offers new insight into the interpretation of observed correlograms for streamflow sequences. Autoregressive models, for which h=1/2, cannot reproduce the structures of observed correlograms; the structures are symptomatic of long-term persistence as indicated by observed values of h greater than 1/2. If sequences are generated by long memory processes, then the utility of the tests for independence is low for short records. Consequently, correlograms may be useful indicators of long-term persistence when more formal tests give contrary results. (Knapp-USGS) W72-02863

EVALUATING ALTERNATIVE TECHNIQUES

OF FLOODPLAIN MAPPING,
Johns Hopkins Univ., Baltimore, Md. Dept. of
Geography and Environmental Engineering.
For primary bibliographic entry see Field 07C.
W72-02864

STATISTICAL PROPERTIES MIII TIVARIATE FRACTIONAL. NOISE. PROCESSES,

Geological Survey, Washington, D.C. N. C. Matalas, and J. R. Wallis. Water Resources Research, Vol 7, No 6, p 1460-1468, December 1971. 4 fig, 1 tab, 12 ref.

Descriptors: \*Streamflow forecasting, \*Statistics, \*Correlation analysis, \*Variability, Markov processes, Stochastic processes, Regression analy-

Identifiers: Correlogram analysis.

Fractional noise processes belong to a class of stochastic processes that lie outside the Brownian domain of attraction. They are characterized by in-finite memories and a parameter h that is the asymptotic slope of log (R/S) versus log N, where R asymptotic stope of log (x/s) versus og x, where x is the range of cumulative departures from the sample mean, s is the sample standard deviation, and N is the sample size. The parameter H may be used to generate synthetic flows whose means, variances, skewnesses, lag one serial correlations, lag zero cross correlations, and h values are like those for historical flow sequences. Historical flow sequences yield values of h not equal to 1/2. Although Markov processes, which belong to the Brownian domain, can preserve the values of the historical moments in the synthetic sequences, these processes generate sequences in which h tends to the value 1/2 as the sequences lengths tend to infinity. (Knapp-USGS) W72-02865

#### Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4A-Control of Water on the Surface

A STATISTICAL METHOD FOR FLOW PRE-DICTION, RIVER MURRAY EXAMPLE, Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Mathe-

matical Statistics.

Matter Resources Research, Vol 7, No 6, p 1469-1484, December 1971. 4 fig, 4 tab, 11 ref.

Descriptors: \*Streamflow forecasting, \*Correlation analysis, \*Regression analysis, Statistics, Statistical methods, Variability. Identifiers: Australia, River Murray.

Use of multiple linear regression enabled prediction equations to be obtained for the flow of water leaving the River Murray, Australia. The predictors, which are flow readings taken over the previ-ous 5 days, are highly correlated and subject to error, so a direct application of regression may give unreliable results. Therefore the correlations between the predictors were investigated by principal component analyses to overcome these difficulties. A reduced number of new variates approximating the principal components, retained the relevant information, were nearly uncorrelated, and could be interpolation in time. The regression equations were tested for both heterogeneity and stability. (Knapp-USGS) W72-02866

AN ANALYSIS OF THE LAWS OF STREAM ORDER FOR FIBONACCI DRAINAGE PAT-

South Carolina Univ., Columbia. Dept. of Geology. W. E. Sharp.

Water Resources Research, Vol 7, No 6, p 1548-1557, December 1971. 5 fig, 1 tab, 14 ref, append.

Descriptors: \*Drainage patterns (Geologic), \*Drainage density, Tributaries, Geomorphology, Channel morphology, Statistics, Mathematical stu-dies, Topography, Terrain analysis. Identifiers: Stream order, Fibonacci tree, Topolo-

The interpretation of a Fibonacci tree as a stream drainage pattern leads to an exact description of all the stream order properties by Fibonacci numbers. The asymptotic bifurcation ratio for both Horton and Strahler orders is the special constant 1...tau where tau is the famous golden ratio 1.618. Even though Fibonacci patterns account for only a small percentage of the topologically distinct drainage patterns, the Fibonacci growth can be generalized by introducing variable maturing and gestation periods to generate a large variety of stream patterns. (Lang-USGS) W72-02868

PROBABILITY DISTRIBUTION OF NUMBER OF NETWORKS IN TOPOLOGICALLY RANDOM NETWORK PATTERNS,

Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.

M. F. Dacey. Water Resources Research, Vol 7, No 6, p 1652-1657, December 1971. 2 fig, 1 tab, 8 ref. NSF Grant GS-2967.

Descriptors: \*Drainage patterns (Geologic), \*Mathematical studies, \*Tributaries, Geomorphology, Channel morphology, Statistics, Topography, Networks, Probability, Distribution patterns, Drainage density. Identifiers: Topology.

The probability distribution of the number of channel networks for Werner's model of topologically random network patterns obeys a shifted negative or inverse hypergeometric probability law. When the number of exterior links is large, it is approximated by a shifted negative binomial probability law. (Knapp-USGS) W72-02874

STATISTICS OF GREAT LAKES LEVELS. United States Lake Survey, Detroit, Mich.

For primary bibliographic entry see Field 02H. W72-02880

STUDIES ON THE EFFECTS OF RESTRICTED ROOTING DEPTH ON THE PRODUCTION OF

GRASS AND SCOTS PINE, Wollongong Univ. Coll. (Australia). F. Beavington, and S. V. Adu. Can J Soil Sci. 51 (1): 127-128. 1971. Identifiers: Compact, Depth, Grass-M, Pine-G, Production, Restricted, Rooting, Scots, Soil.

The effect has been studied of restrictions to the root systems of grass and Scots pine caused by a strongly compacted soil horizon generally located at 40-60 cm below the soil surface. Yields at the 24 grassland sites were measured for the 1966 growing season on 4 randomly distributed plots, 1.22 x 0.91 m (4 x 3 ft) (2). Tree production was measured at the 50 forest sites, each 101.2 sq cm (1/40 acre), by means of age, circumference at breast height, mean annual height increment (measured from the mean growth of 5 internodes above breast height), and top height which was converted into volume production classes. No correlation was found between grass yields and total rooting depth (r — ..0.138). Rainfall was well distributed through the 1966 growing season, and of average amount, the mean total of 4 sites in the area for the 6 mo. from May to Oct. being 50.1 cm. It would seem that shallow-rooting plants, such as grass, are affected, in the main, only by soils shallower than were found in this area. However, all measurements used to determine tree production correlated significantly with total rooting depth; the correlation coefficient for volume production was ..0.578, significant at the 0.1% level, and indicating that 33% of the variation was associated with rooting depth. Total variation was associated with footing depth, therefore, is an important limiting factor in the growth of Scots pine in western Aberdeenshire. Total rooting depth, moreover, seemed to be a more important limiting factor in the growth of mature Scots pine than of young In many upland areas such as this, where precipitation is moderate, slopes are steep and runoff is relatively high, tree production may be limited by the effect of impenetrable barriers in reducing rooting volume. Quantitative data on the depth of soil available for root exploration are, therefore, of considerable significance.—Copyright 1971, Biological Abstracts, Inc.

THE PEDOAMELIORATIVE EFFICIENCY OF SOME DRAINING SYSTEMS IN TARA BIRSEI, Institutul de Cercetari Pedol. (Rumania). For primary bibliographic entry see Field 02G. W72-02941

#### 4B. Groundwater Management

BASE OF FRESH GROUND WATER (APPROXI-MATELY 3,000 MICROMHOS) IN THE SAN JOAQUIN VALLEY, CALIFONRIA, Geological Survey, Menlo Park, Calif. Water

Resources Div.

R. W. Page. Geological Survey Open-file Report, 1971. 13 p, 3 fig, 1 plate, 52 ref.

Descriptors: \*Water resources development, \*Groundwater, \*Fresh water, \*Water quality, \*California, Hydrologic data, Water wells, Aquifers, Aquifer characteristics, Water demand, Conductivity, Electrical conductance, Dissolved solids, Electrical well logging, Water yield, Withdrawal, Groundwater recharge, Pumping, Water level flunctuations, Salinity, Hydrographs, Maps. Identifiers: \*San Joaquin Valley (Calif)

The southern eight-ninths of the San Joaquin Valley, about 10,000 square miles, is a broad structural trough bordered by the Sierra Nevada on the east and by the Coast Ranges on the west. In that area, fresh groundwater is contained in principally un-

colsolidated continental deposits of Pliocene to coisolidated continental deposits of Pilocene to Holocene age that extend to depths ranging from less than 100 to more than 3,500 feet. Because of widespread pumping of groundwater, water levels have declined rapidly beneath extensive areas of the valley. Consequently, it becomes necessary to delineate the base of fresh water so that changes in defineate the oase of fresh water so that changes in thickness of the fresh-water zone can be monitored, and limiting depths of water wells can be determined. A specific conductance of 3,000 micromhos per centimeter (about 2,000 milligrams per liter dissolved solids) was selected as a measure of the base of fresh segundance in Sea Logorija. of the base of fresh groundwater in San Joaquin Valley, California. The base of fresh water comis in the continental deposits of Tertiary and Quaternary age, but in places along the eastern and western boundary of the valley it occurs in marine and continental sedimentary rocks of Tertiary age. Nearly everywhere in the valley, the fresh water is underlain by a basal, saline water body of a sodium chloride type. (WOODARD-USGS) W72-02258

WATER RESOURCES OF THE COAMO AREA,

PUERTO RICO, Geological Survey of Puerto Rico, San Juan. E. V. Giusti. Puerto Rico Water Resources Bulletin 9, 1971. 31 p, 18 fig, 7 tab, 2 ref.

Descriptors: \*Water resources development, \*Sur-Descriptors: "Water resources development, "Surface waters, "Groundwater, "Hydrologic data, "Puerto Rico, Data collections, Rainfall-runoff relationships, Water yield, Hydrologic budget, Water balance, Aquifers, Aquifer characteristics, Withdrawal, Groundwater recharge, Hydrogeology, Water quality, Water level fluctuations, Dry seasons, Droughts, Chemical analysis. Identifiers: "Coamo (PR).

The water resources of the 100 square miles of land centered on the town of Coamo, Puerto Rico, were studied in 1967, a dry year which occurs once in 50 years on the average. The flow of Rio Coamo, the only perennial stream, was 6,500 acre-feet into Lago Coamo, 1,200 acre-feet below the Lago Coamo dam, and 270 acre-feet into the sea. Correlation between rainfall and runoff indicates that the average flow of Rio Coamo into Lago Coamo is about 35,000 acre-feet per year. Much of this is in floodflow that cannot be retained in the small reservoir. Pumpage of groundwater in the Coamo fan amounted to 52,000 acre-feet in 1967. This resulted in lowering the water table in the alluvium 5 to 12 feet. The water table declined from heavy pumpage during the drought that began in 1964, to such an extent that the groundwater table in a large part of the Coamo fan was below mean sea level in 1967. The water budget shows that 30 percent of the water used in furrow irrigation in 1967 was returned to the water table and recirculated. This prevented a more serious lowering of groundwater, and may have retarded salt-water intrusion. The Coamo fan is naturally semiarid, and continuing drought and heavy pumpage would result is successively lower water levels and salt-water intrusion in wells near the coast. Possible remedial measures worthy of investigation for improving the utiliza-tion of the water resources of the Coamo area are presented. (Woodard-USGS) W72-02272

SUMMARY OF WATER RESOURCES OF SALT LAKE COUNTY, UTAH,

Geological Survey, Salt Lake City, Utah. A. G. Hely, R. W. Mower, and C. A. Harr. Available from Utah Dept of Natural Resources, Div of Water Rights, 442 State Capitol, SLC, Utah. Utah Department of Natural Resources Technical Publication No 34, 1971. 31 p, 6 fig, 2 tab, 76 ref, append.

Descriptors: \*Water resources development, \*Surface waters, \*Groundwater, \*Reviews, \*Utah, Future planning (Projected), Water yield, Water quality, Water supply, Water users, Water balance, Hydrologic budget, Streams, Aquifers, Withdrawal,

#### WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

#### Groundwater Management—Group 4B

Water wells, Groundwater recharge, Hydrologic data, Watershed management.
Identifiers: \*Salt Lake County (Utah).

The average total annual water withdrawals from The average total annual water windrawas from surface and underground sources in Salt Lake County, Utah, during 1964-68 were about 580,000 acre-feet for all uses that deplete the supply, except that used for maintenance of water-fowl-management areas. The withdrawals projected for the 2020 are 1,200,000 acre-feet. The maximum annual firm supply that can be derived from the sources now available is about 700,000 acre-feet, of which about 200,000 acre-feet would be derived from subsurface sources. Achievement of this an-nual yield would require nearly complete regula-tion of streamflow that now is practically unregulated, larger drawdowns of groundwater levels than have been experienced, and overall management of nave been experienced, and overall management or surface and subsurface sources as parts of a single resource. A bibliography containing 76 publica-tions of the Utah Department of Natural Resources, Division of Water Rights is included. (Woodard-USGS) W72-02273

WATER RESOURCES OF PUERTO RICO, PHASE II: GROUND WATER APPRAISAL. Domenech (R.A.) and Associates, Hato Rey (Puerto Rico); and Black and Veatch, Kansas City, Mo.

Available from NTIS, Springfield, Va. 22151 as PB-201 641, \$3.00 in paper copy, \$0.95 in microfiche. Puerto Rico Planning Board Aqueduct and Sewer Authority Report, June 1970. 211 p, 28 fig, 29 tab, 58 ref, append.

Descriptors: \*Water resources development, \*Groundwater, \*Puerto Rico, Reviews, Planning, Hydrogeology, Aquifers, Water yield, Water supply, Water wells, Water quality, Hydrologic data, Groundwater recharge, Rainfall-runoff relationships, Chemical analysis, Water users, Aquifer characteristics, Water balance.

Identifiers: \*Groundwater hydrology (Puerto Rico)

Rico).

The quantity and quality of groundwater available in Puerto Rico are appraised and the type and scope of future groundwater investigations needed to improve the water management program administered by the Commenwealth are discussed. The island is divided into seventeen groundwater regions. Areal and aquifer water balances are used to determine potential aquifer yields and to identify the magnitude of the recharge received from the different sources. These yield and recharge ap-praisals are calculated for both average and adverse climatic conditions. Relatively large quanti-ties of groundwater appear to be available in the limestone formations located along the north coast of the island and in the alluvial valleys located along the east coast of the island and in the Guanajibo Valley. The large and productive groundwater aquifers located along the south coast of the island are already extensively developed. Op-portunities for obtaining additional water from these aquifers are very localized. Information on aquifer characteristics and well performance are summarized for each area. The costs associated with well development are also presented. (Woodard-USGS) W72-02291

HYDROLOGY OF THE PLEISTOCENE SEDI-MENTS IN THEWYOMING VALLEY, LU-ZERNE COUNTY, PENNSYLVANIA.

Geological Survey, Harrisburg, Pa. J. R. Hollowell.

Pennsylvania Geological Survey Water Resource Report 28, 4th Series, 1971. 77 p, 16 fig, 4 plate, 7 tab, 27 ref, append.

Descriptors: \*Water resources development, \*Groundwater, \*Hydrogeology, \*Hydrologic data, \*Pennsylvania, Aquifers, Water yield, Water quali-ty, Water demand, Data collections, Water table, Water level fluctuations, Withdrawal, Aquifer characteristics, Groundwater recharge, Geology, Water users, Water wells, Chemical analysis, Reviews, Forecasting.

Identifiers: \*Luzerne County (Penn), Groundwater

resources.

Thick accumulations of glacial till, outwash deposits, and lake deposits underlie the Wyoming Valley in Luzerne County, Penn. Outwash deposits of sand and gravel overlying the lake deposits yield as much as 1,200 gpm. The glacial deposits beneath the valley flood plain constitute the most important aquifer in the Wyoming Valley. The aquifer is used only for irrigation at present. Recharge to the aquifer, mainly from precipitation, is estimated to be 15 inches per year. Natural discharge from the glacial deposits is mainly by seepage into the streams. Over 1 billion gpd of groundwater probably could be obtained by pumping wells placed near the river and inducing water into the aquifer from the Susquehanna River. The infilitration water would have a relatively constant temperature, quality, and quantity adequate for mu-nicipal or industrial use. The groundwater in the glacial deposits is predominantly of the calcium bicarbonate-sulfate type, high in dissolved solids, and hard. Locally, the quality is affected adversely by surface deposits of mine waste which contribute large quantities of leached calcium, iron, and sulfate ions to the groundwater. (Woodard-USGS) W72-02303

YIELDS AND SPECIFIC CAPACITIES OF BEDROCK WELLS IN KENTUCKY,

Geological Survey, Louisville, Ky. D.V. Whitesides.

Kentucky Geological Survey Information Circular 21, 1971. 18 p. 5 fig, 1 tab, 57 ref.

Descriptors: \*Groundwater, \*Water \*Specific capacity, \*Water wells, \*Kentucky, Aquifers, Aquifer characteristics, Pumping, Drawdown, Hydrologic data, Data collections, Water resources development, Water level fluctuations, Hydrogeology, Hydrographs. Identifiers: \*Groundwater resources (Ky), Well

Specific-capacity and well-yield data are presented from controlled pumping tests on 106 selected bedrock wells in 41 counties in Kentucky. Occurrence and movement of groundwater in bedrock aquifers are discussed. Depths of wells tested range from 21 to 1,015 feet and yields range from less than one to several hundred gallons per minute. Water from bedrock aquifers will need to be developed and utilized as demand for water increases along with population growth and industrial expansion in Kentucky. Adequate groundwater supplies from bedrock wells for domestic and small industrial use could in all probability be developed in some areas which are far removed from major streams and existing surface reservoirs. The cost of individual wells would be considerably less than the cost of installing long stretches of pipeline, filtra-tion and treatment facilities, or building new surface reservoirs. (Woodard-USGS) W72-02305

AN EVALUATION OF GROUND-WATER CON-DITIONS IN THE VICINITY OF THE BEL BAY DEVELOPMENT, LUMMI INDIAN RESERVA-TION, WASHINGTON.

Geological Survey, Tacoma, Wash.

Geological Survey Open-file Report, October 1971. 29 p, 2 fig, 3 tab, 4 ref, append.

Descriptors: \*Groundwater, \*Aquifer characteristics, \*Water supply, \*Indian reservations, \*Washington, Hydrologic data, Data collections, Pumping, Withdrawal, Drawdown, Water yield, Water quality, Salinity, Saline water intrusion, Groundwater recharge, Hydrogeology. Identifiers: \*Lummi Indian Reservation (Wash). Groundwater conditions were determined in the vicinity of the Bel Bay Community and Water Association development on the Lummi Indian Reservation, Washington. When the community well owned by ArtPierre-located 210 feet from the high-tide line on Bellingham Bay-- is pumped at the continuous rate of about 5 gpm, the average groundwater level at this well is lowered from 2 feet above mean sea level to about sea level. If the Bel above mean sea level to about sea level. If the Bel Bay well-located 840 feet from the high-tide line and 710 feet north-northwest and inland of the Pierre well-were pumped at 24 gpm continuously its drawdown would lower the average pumping level in the Pierre well. The cone of depression caused by pumping the Bel Bay well at a rate of 24 gpm would reach the marine shoreline within 100 days. The landward movement of salty groundwater would increase at a rate dependent on the hydraulic connection between the fresh- and saltwater bodies. Such a hydraulic connection is known to exist but the degree of connection was not established. (Woodard-USGS) W72-02320

OF WATER MOVEMENT THROUGH SOILS-A FIRST STEP IN WASTE TRANSPORT ANALYSIS,

Batelle Memorial Inst. Richland, Wash. Pacific Northwest Lab. For primary bibliographic entry see Field 05B. W72-02415

INTEGRATED MANAGEMENT METROPOLITAN WATER SERVICES New York State Dept. of Environmental Conserva-tion, Albany. Div. of Water Research. For primary bibliographic entry see Field 06B. W72-02479

QUALITY OF UNDERGROUND WATER AND ITTS POSSIBLE UTILIZATION FOR COPRODUCTION IN WESTERN RAJASTHAN. Rajasthan Salinity Lab., Jodhpur (India). K. M. Mehta, S. S. Puntamkar, S. P. Seth, and O. P. Indian J Agr Sci. 40 (9): 776-781. 1970.

Descriptors: \*Groundwater. Identifiers: Adsorption, Crop, India, Production, Rajasthan, Ratio, Saline, Sodium, Underground,

Analysis of 50 representative samples showed that the majority of waters were saline and a few samples from Pali were alkaline. Na, the predominating cation in all the waters, makes the utilization of the water difficult. All water samples except those from Barmer and Jaisalmer had a high Na adsorption ratio. These underground waters are being used without any harmful effect.—Copyright 1971, Biological Abstracts, Inc. W72-02621

HIGH-CAPACITY WELLS FOR CONJUNCTIVE USE OF WATER, Geological Survey, Denver, Colo. H. H. Ham. GroundWater, Vol 9, No 5, p 4-11, September-October 1971. 7 fig, 6 ref.

Descriptors: \*Hydrogeology, \*Conjunctive use, \*Idaho, Aquifer characteristics, Aquifers, Basalts, Irrigation water, Water resources development, Water yield, Water wells.

The Bureau of Reclamation's authorized Lower Teton Division multipurpose project is based on conjunctive use for irrigation of surface water from the Snake River and groundwater from the Snake Plain basalt aquifer of southeastern Idaho. Ground-water will be provided to replace surface water ad-versely diverted to Division lands during dry years. Extensive investigations, include the construction and testing of five test wells of 12- to 18- cfs capacity. Use of large wells is feasible, and the boralt

#### Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4B-Groundwater Management

aquifer will yield 400 cfs without appreciable detri-mental effect. Location of well fields and design and construction practices were primarily con-trolled by field conditions; use of theoretical parameters was essentially precluded. (Knapp-USGS)

W72-02757

ESTIMATING TRUNCATION ERROR IN IMAGE WELL THEORY,
Arizona Univ., Tucson. Dept. of Hydrology and

Water Resources. C. A. Bostock.

Water Resources Research, Vol 7, No 6, p 1658-1660, December 1971. 3 fig, 3 ref.

Descriptors: \*Drawdown, \*Water levels, \*Theis ransmissivity, Well spacing.
Identifiers: \*Image well theory.

Groundwater production from wells located beyond a distance that is large relative to the spacing between adjacent image wells may be treated as an equivalent, continuous, constant production rate per unit of ground surface area. The Theis equation is useful for calculating the minimum radius of the image well model in which image wells must be included for a given pumping time to keep the truncation error due to omitted image wells less than some predesignated value. If an image well model is composed of a fixed number of image wells for approximately an really infinite system then the equation will give the maximum allowable pumping time for a given allowable truncation error. (Knapp-USGS) W72-02875

#### 4C. Effects on Water of Man's Non-Water Activities

ARECONNAISSANCE OF STREAMFLOW AND FLUVIAL SEDIMENT TRANSPORT, INCLINE VILLAGE AREA, LAKE TAHOE, NEVADA, FIRST PROGRESS REPORT, 1970,

Geological Survey, Carson City, Nev. For primary bibliographic entry see Field 02J. W72-02329

SPAWNING AREAS AND ABUNDANCE OF STEELHEAD TROUT AND COHO, SOCKEYE, AND CHUM SALMON IN THE COLUMBIA RIVER BASIN: PAST AND PRESENT, National Marine Fisheries Service, Seattle, Wash.

Diological Lab.

Leonard A. Fulton.

U S Fish Wildl Serv Spec Sci Rep Fish. 618. 1-37. Illus. Map. 1970.

Identifiers: Abundance, Basin, Chum, Coho, Columbia, Fishery, Oncorhynchus-Keta, Oncorhynchus-Nerka, River, Salmo-Gairdneri, \*Salmon, Sockeye, Spawning, \*Steelhead, \*Trout, USA.

Past spawning areas (those removed from use before 1969) and present ones (those in use in 1969) are described for steelhead trout, Salmo gairdneri; coho salmon, Oncorhynchus kisutch; sockeye salmon, O. nerka; and chum salmon, O. keta. The different species characteristically spawn in the fol-lowing areas: steelhead trout-in streams of all sizes (widely dispersed throughout the watershed, coho salmon-in small streams (mostly in the lower tributaries) and in a few areas in the middle watershed, sockeye salmon-in lakes and tributaries of lakes (in the middle portion of the watershed), and chum salmon-in lower portions of tributaries that enter the Columbia River below The Dalles Dam. All 4 spp. have lost many spawning areas because of water-use developments and changes in the watershed resulting from logging, highway construction, agricultural cultivation, placer mining, and dumping of wastes. Serious depletion of the runs of all 4 spp. is evident from the available data (the commericial catches before 1938 and since 1938 augmented by information on escapement and sport catch). The future prospects are fair for steelhead trout, good for coho salmon, and poor for sockeye and chum salmon.--Copyright 1971, Biological Abstracts, Inc.

#### 4D. Watershed Protection

PRINCIPLES FOR THE LOCATION OF MEASURES OF EROSION CONTROL IN ARMENIAN HIGHLANDS (IN AMERICAN),

E. M. Airapetyan. Izv Selskokhoz Nauk. 6.7. 101-108. 1968. Identifiers: Armenian, Control, \*Erosion, Highlands, Location, Maps, Measures, Principles,

Measures of erosion control for Armenian highlands are planned within the boundaries of catchment basins. Measurements and procedures for building the location maps based on land capa-bility maps are given. The lands are divided into the following categories: irrigated and nonirrigated plowlands, long-fallow, pastures and wastelands. Especially important is the location of field shelterbelts.—Copyright 1971, Biological Abstracts, Inc. W72-02624

A STUDY ON GULLY EROSION AND VEGETA-TION IN THE LOWER WATERSHED OF SLANICUL BUZAU,

Institutul Agronomic, Bucharest (Rumania). R. V. Stefan

Lucrari Stiint Inst Agron 'N Balcescu' Sera. 12: 507-521. Illus. 1969 (Engl, Fr and Russ summ). Identifiers: Buzau, Cropping, Erosion, Gully, Lower, Romania, Slanicul, Slope, Steep, Vegeta-

The higher energy of the relief, the steep slopes and over-cropping resulted in gully erosion process.--Copyright 1971, Biological Abstracts, Inc. W72-02914

TERRAIN ANALYSIS OF THE AMNER BASIN,

R. M. Pofali, and J. C. Bhattacharjee.
J Indian Soc Soil Sci. 18 (3): 279-287. Illus. Map.

Identifiers: Amner, Basin, India, Terrain.

The western hilly region of the Amner basin is characterized by a plateau, an inner synclinal basin ad encircling folded hill ranges with several watergaps. The frontal hill range merges with the vast plain land in the east. Active vertical erosion in the plain land in the east. Active vertical erosion in the hilly region has dissected the land giving the appearance of bad-land topography. In the plain, rivers flow sluggishly due to loss of gradient and deposit their loads. The basin was subjected to a multiple cycle of erosion, maturity being attained in the present cycle. A study of land form evolution of the basin will help in understanding the complex nature of soils and better planning of soil conservation measures.—Copyright 1971, Biological Abstracts, Inc. W72-02944

#### 05. WATER QUALITY MANAGEMENT AND **PROTECTION**

#### 5A. Identification of Pollutants

CONCENTRATION OF MINOR ELEMENTS IN CALIFORNIA STREAMS, 1960-69, Geological Survey, Menlo Park, Calif., Water Resources Div. For primary bibliographic entry see Field 02K. W72-02253

THE RATE OF OXIDATION OF PETROLEUM PRODUCTS IN WATER WITHOUT ADDITION OF NITROGEN, For primary bibliographic entry see Field 05B. W72-02257

SELENIUM IN LAKE SEDIMENTS -- ANALYTI-CAL PROCEDURE AND PRELIMINARY RESULTS,

Wisconsin Univ., Madison. Water Chemistry Pro-

For primary bibliographic entry see Field 02H. W72-02300

APPLICATION OF ANODIC-STRIPPING VOL-TAMMETRY TO THE DETERMINATION OF SOME TRACE ELEMENTS IN SEA WATER, Naval Weapons Center, China Lake, Calif For primary bibliographic entry see Field 02K. W72-02333

IDENTIFICATION AND CHARACTERIZATION OF OIL POLLUTANTS IN WATER VIA SIMUL-TANEOUS GAS CHROMATOGRAPHY EM-PLOYING FLAME IONIZATION AND FLAME PHOTOMETRIC DETECTORS FOR SULFUR AND PHOSPHORUS,

Environmental Protection Agency, Chicago, Ill., Water Quality Office.

Water Quality Office.
W. D. Johnson, and F. D. Fuller.
Proceedings Thirteenth Conference on Great
Lakes Research, April 1-3, 1970, State University
College, Buffalo, N Y, Part 1: International Association for Great Lakes Research, p 128-136, 1970. 5 fig, 5 tab, 9 ref.

Descriptors: \*Gas chromatography, \*Pollutant identification, \*Oily water, Sulfur, Phosphorus, Analytical techniques, Instrumentation, Water analysis, Water pollution sources, Great Lakes. Identifiers: \*Simultaneous gas chromatography. \*Oil spills.

An analytical method was devised to assist in identifying the source of oil pollution. The phosphorus and sulfur in oil can be used quantita-tively and qualitatively to differentiate between vegetable oils, petroleum oils, and mixtures by simultaneous gas chromatography. Petroleum pol-lutants can be characterized by determining the number of carbon compounds present and simul-taneously determining the presence of sulfur and phosphorus. The sulfur and phosphorus detected in oil pollutants are correlated with flame ionization results to give added conformation. (See also W72-01094) (Knapp-USGS) W72-02334

PROCEEDINGS WORKSHOP ON TOXIC METALS IN WATER.
North Carolina Water Resources Research Inst. Raleigh; and North Carolina State. Dept. of Natural Carolina State. ral and Economic Resources, Raleigh.

Available from the National Technical Service as PB-205 176, \$3.00 in paper copy, \$0.95 in microfiche. Report No 57, UNC-WRRI-71-57, Au-gust 17, 1971. 120 p. OWRR A-999-NC (24).

Descriptors: \*Metals, \*Heavy metals, \*Trace elements, \*Monitoring, \*Water pollution sources, \*Pollutant identification, \*North Carolina, Toxicity, Water quality control. Identifiers: \*Toxic metals, \*North Carolina, \*Toxic

The objectives of this workshop were to evaluate the state of the art of monitoring for toxic metals in the surface waters of North Carolina; the significance of present findings to human health and aquatic ecosystems; the adequacy of present programs as to coverage, technology, and coordination between monitoring agencies; needed changes in agency programs, laws and regulations; and research needs. Participants included representa-tives from industry, public agencies, and the

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Identification of Pollutants-Group 5A

academic community. Conclusions: (1) Information on uses of toxic metals is not generally availa-ble, (2) Present monitoring practice for toxic metals in water, sediment, and biota is inadequate, (3) There is need for better coordination of moni toring activities to make better use of available resources and data. (Howells-North Carolina) W72-02352

DETERMINATION OF LEAD IN BIOLOGICAL AND RELATED MATERIAL BY ATOMIC ABSORPTION SPECTROPHOTOMETRY,

Cincinnati Univ., Ohio. Dept. of Environmental

D. W. Yeager, E. W. Henderson, and J. Cholak. Environmental Science and Technology, Vol 5, No. 10, October 1971, p 1020-1022, 1 fig, 3 tab, ll

Descriptors: \*Pollutant identification, \*Analytical Chelation,

techniques, Chelation, Iron, Copper, \*Sprectrophometry. Identifiers: \*Lead, \*Atomic absorption spec-trophotometry, Interferences, Zinc, Bismuth, Cad-

A simple single extraction procedure applicable to the atomic absorption spectrophotmetric deter-mination of trace quantities of lead in all types of biological and related material has been developed. The method involves the chelation of lead with ammonium pyrrolidine dithiocarbamate (APDC) at pH 8.5 and extraction of the chelate into a small volume of methyl isobutyl ketone for aspiration into the burner of the instrument. Potassium cyanide is used to mask the effects of iron, zinc, and copper. Only bismuth and cadmium of the metal ions that react with APDC at pH 8.5 have been encountered as interferences. Procedures are suggested for analyzing materials containing large quantities of bismuth and cadmium. The method is particularly useful for the determination of lead in the range of 0.05 to 20 micro-grams. It may be equally adaptable to the determination of bismuth, cadmium, manganese, antimony, selenium, telluri-um, and thallium. (Goessling-Texas) W72-02375

MEASUREMENT OF POLLUTANT TOXICITY TO FISH-III SUBLETHAL EFFECTS AND "-SAFE" CONCENTRATIONS,

Guelph Univ. (Ontario). Dept. of Zoology. For primary bibliographic entry see Field 05C. W72-02380

ZONAL CENTRIFUGATION--A TOOL FOR EN-

VIRONMENTAL STUDIES,
Oak Ridge National Lab., Tenn. Applied Physics

W.P. Bonner, C. W. Francis, Tsuheo Tamura, and

J. W. Amburgey, Jr. Environmental Science and Technology, Vol 4, No. 10, October 1970, p 821-825, 5 fig, 1 tab, 10

Descriptors: \*Centrifugation, \*Sediments, \*Density, Clays, Calcareous soils, Physical properties, Flocculation, \*Analytical techniques, Separation techniques, X-ray diffraction, Electron microscopy, Ultrasonics, Pollutant identification. Identifiers: \*Isopychic point.

A laboratory separation technique has been developed which neither alters nor destroys the compound of interest. The method, zonal centrifugation (Z-C) involves preparing a continuous density gradient solution, layering the tests sample on the gradient solution, and centrifuging the tubes to allow each component to collect at its isopycnic point. This particular method was successfully used to suspend and band environmental samples con-taining clay minerals. A calcareous pond sediment was tested, and it separated into five bands when dispersed and banded in a gradient solution (density 1.8 to 2.8 g/cc). A suspending agent, a polyvinyl-pyrrolidone polymer (PVPK-30) was used to

prevent flocculation of the particles. Each of the different density layers was then subjected to x-ray diffraction and electron microscopy analysis. These analytical techniques were then able to detect materials which were not detected in the unbanded samples. In addition to the separation and identifiations samples. In addition to the separation and identification of inorganic components, this technique produces nearly quantitative separation of calcium carbonate, the presence or absence of which dictates many chemical processes. The zonal centrifugation process will be a useful technique in establishing these and other environmental relationships. (Lowry-Texas)

MONITORING OF LOW-LEVEL VIRUS IN NATURAL WATERS,
Texas Univ., Austin. Environmental Health En-

gineering Research Lab.
C.A. Sorber, B. P. Sagik, and J.F. Malina, Jr.
Applied Microbiology, Vol 22, No. 3, September
1971, p 334-338, 4 fig. 2 tab, 13 ref

Descriptors: \*Pollutant identification, \*Viruses, \*Electrolytes, Analytical techniques, Laboratory tests, Hydrogen ion concentration, Tracers, Water quality control, Public health, \*Monitoring. Identifiers: \*Polyelectrolytes, Concentration technique.

Major epedemics have been attributed to waterborne viruses. Indications are that the average per-son in the United States is afflicted by viral diseases during 10% of his life. The insoluble polyelectrolyte technique of concentrating virus has been extended to extremely low virus concentration levels. The effectiveness of this method employing a coliphage T2 model was a constant 20% over the range of virus levels from 103 to .0001 plaque-forming units/ml. The efficiency of the method is dependent upon pH control during the concentration phase. Experiments determined that variations in pH of 0.3 pH units from the optimum of 5.25 for the water used in this study resulted in significant reduction in recovery. Radiotracer studies found that although 20-25% of the virus titer were that atthough 20-25% of the virus titer were recovered and plated, it was found that 56% of the virus remained attached to the polyelectrolyte. No evidence could be found to verify that viable virus remained in the raw water. This technique satisfies the requirement to monitor the effectiveness of water and wastewater treatment in removing virus. In addition, its potential as a monitoring technique for low-level virus in raw water appears great. (Goessling-Texas) W72-02388

THE ROLE OF BENTHOS AND PLANKTON STUDIES IN A WATER POLLUTION SURVIELLANCE PROGRAM,

Robert A. Taft Sanitary Engineering Center, Cin-cinnati, Ohio.

J. B. Anderson, E. B. Henson, and C. I. Weber. Proceedings, Industrial Waste Conference, 20th, May 4, 5, and 6, 1965. p275-296, 10 fig, 7 tab, 10

Descriptors: Water pollution sources, \*Plankton, \*Benthos, Worms, Mollusks, Insects, Crustaceans, On site data collections, On site tests, Laboratory Nutrients, Toxicity, Sampling, \*Pollutant identification.

Identifiers: Diversity index, Bryozoa.

There are 131 sampling stations in the Water Pollution Surveillance System operated by local cooperating angencies and supervised by the Public Health Service. Initial tests were conducted to determine physical, chemical, and biological properties of the water at these stations. In 1962, the program was extended to include determinations of the benthos and plankton. The data obtained in useful in characterizing the quality of the water at the stations. Populations and population changes can be used to estimate levels of enrichment and to detect influences of toxic materials. A continuing program of regular sampling is very useful for

establishing normal population characteristics and for detecting significant changes that are related to pollution or other water quality changes. Data on benthos and plankton supplement physical and chemical data. The responses of biological changes can be detected and associated with chemical and physical variations when appropriate and adequate records are maintained. (Goessling-Texas) W72-02419

SURVEILLANCE FOR CHLORINATED HYDROCARBON PESTICIDES IN SURFACE SURVEILLANCE

Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.

A. W. Breidenbach.

Proceedings, Industrial Waste Conference, 20th, May 4, 5, and 6, 1965. p 248-253, 1 tab, 2 fig, 11

Descriptors: Water pollution sources, \*Chlorinated hydrocarbon pesticides, Surface waters, On site data collections, Laboratory tests, Activated carbon, Separation techniques, Gas chromatography, \*Pollutant identification, Sampling, Analytical techniques.

The Public Health Service Water Pollution Control Surveillance System includes 131 surface-water sampling stations on major waterways and modern laboratory facilities in Cincinnati, Ohio. Other agencies, federal, state and local, as well as industry and universities participate in these activities. The system provides data on the nature and extent of pollution of our major waterways. Chlorinated hydrocarbon pesticides are of particular im-portance to the laboratory because of the toxicity to fish of some members of this group of com-pounds. Surveillance for chlorinated pesticides in surface waters dates back to 1959. The test procedure involves filtering a fairly large sample of water through an activated carbon cartridge. This cartridge is sealed and sent to the laboratory for analysis. The advent of gas chromatographic equip-ment, particularly the microcoulometric titration ctron capture detectors, has permitted us to identify smaller concentrations in smaller samples which greatly facilitates our work. It appears that chlorinated hydrocarbon pesticides are rather generally present in surface waters in low concentrations. These compounds show the capability to adsorb on a variety of solids and may be expected to be associated with the suspended solids in the water and with the solids of the benthic environment. (Goesslong-Texas) W72-02421

THE UPTAKE OF P32 AND CA45 BY PURE AND MIXED CULTURES OF BACTERIA.

AND MIAED CULTURES OF BRC 1EAG, Howard Univ., Washington, D. C. M. M. Varma, and D. H. Stonefield. Proceedings, Industrial Waste Conference, 21st, May 3, 4, and 5, 1966. p 103-116, 11 fig, 12 ref.

Descriptors: Water quality control, Tracers, \*Bioindicators, \*E. coli, Laboratory tests, Phosphorus, Calcium, Absorption, Correlation analysis, \*Bacteria, \*Waste identification, \*Waste assimilative capacity.

Identifiers: \*Proteus vulgaris.

A series of experiments have been conducted to A senes of experiments have been conducted to determine the suitability of radioactive tracers as a quicker method of establishing the presence of indicator bacteria. ESCHERICHIA coli and PROTEUS vulgaris were used in pure culture to measure the uptake rate of Phosphorus-32 and Calmeasure the uptake rate of Phosphorus-32 and Cal-cium-45. Similar tests were conducted using mixed cultures from raw sewage. Indications are that tests using radioactive tracers can provide an indication of the degree of pollution of water in a few hours rather than the 16 hours to 5 days required for the tests described in 'Standard Methods.' The results indicate: (1) there is a good correlation between the growth of the indicator bacteria and uptake of phosphorus; (2) the assimilative capacity varies from species to species; (3) two distinct rates of as-

#### Group 5A-Identification of Pollutants

similation of the uptake of phosphorus-32 and calsimilation of the uptake of phosphorus-32 and cai-cium-45 exist, one while the bacteria are in the lag phase and the other while the bacteria are in the logorithmic growth phase; (4) calcium-45 is not readily assimilated by the bacteria; and (5) the release of phosphorus during the death phase is much slower than the death rate of the bacteria. (Goessling-Texas) W72-02424

COMPOST STUDIES, Department of Health, Education and Welfare, Washington, D. C., Bureau of Solid Waste Manage-R. D. Lossin.

Compost Science, Vol 11, No 6, November-December, 1970. p 16-17, 5 ref.

Descriptors: \*Solid wastes, Analytical techniques, Laboratory tests, Color, \*Decomposing organic

Identifiers: \*Composting, Starch-iodine complex,

A simple and rapid test has long been needed for determining the degree of decomposition of com-post. Three types of carbohydrates are found in compostable material: sugars, starch, and cellulose. These constituents decrease with the age of the compost. By the time the starch in the organic material has vanished, the compost has an acceptable appearance and odor, has passed its high temperature stage and has reached its maximum pH. The test proposed is based on the formation of the starch-iodine complex. Depending on the form in which the starch is found, a characteristic color is formed. Amylose gives an intense blue-black color; amylopectin gives from light blue to purple to red colors, depending on the degree of branching; and, glycogen gives reddish-brown colors. The color sequence normally followed as the age of the com-post increases in blue-black to light blue to grey to green to yellow. The finished compost tests to a yellow color. The procedures for collecting and preparing the compost sample, extracting any starch that might be present and conducting the test are discussed and possible variations in the results discussed. The starch-iodine test offers a quick, easy and relatively inexpensive means of determining the degree of maturation of compost. More work needs to be done in testing this procedure on different compost products under differing conditions. (Goessling-Texas) W72-02430

EFFECT OF MIXING ON BOD TEST, Central Public Health Engineering Research Inst., New Delhi (India). Delhi Zonal Centre. S. K. Shrivastava, and Radha Charan Dixit. Environ Health. 12 (4): 334-339. Illus. 1970.

Identifiers: Biological, Mixing, Oxygen, Test.

Studies were carried out to evaluate the effects of turbulence on BOD (biochemical oxygen demand). Results were compared with those obtained by the standard method. The rate of BOD progression is incubation. With induced turbulence, it was possible to obtain ulti-mate carbonaceous BOD.--Copyright 1971, Biological Abstracts, Inc. W72-02520 faster if turbulence is created during the period of

DETECTION OF RESIDUAL QUANTITIES OF METHURINE IN WATER, (IN RUSSIAN), D. A. Soboleva, and V. Makarova. Gig Sanit. 35 (11): 64-65. 1970.

Identifiers: Detection, Methurine, Quantities,

Extraction of the herbicide methurine from water samples with n-butyl alcohol or n-amyl alcohol was demonstrated to be very efficient (2-6% error) and suited for optical-density detection in amounts of 200 mg/100ml, but was somewhat less effective at 100 mg/100 ml (10-25% error). Chloroform was not a suitable extractant.--Copyright 1971, Biological Abstracts. Inc.

W72-02524

CALCULATION OF SUBSTANCES IN RIVERS BY A FEW SINGLE ANALYSES IN COM-PARISON TO CONTINUAL CHEMICAL STU-DIES OVER A PERIOD OF ONE YEAR, DEMONSTRATED ON THE ARGEN RIVER, A TRIBUTARY OF LAKE CONSTANCE, (IN GER-

Staatl Institut fuer Seenforschung und Seenbe wirtschaftung, Langenargen (West Germany). For primary bibliographic entry see Field 05B. W72-02526

LISTERIA MONOCYTOGENES IN NATURE, Virginia Commonwealth Univ., Richmond. Medical Coll.

H. J. Welshimer, and Jeanette Donker-Voet. Appl Microbiol. 21 (3): 516-519. 1971. Identifiers: Listeria-Monocytogenes, Nature.

Samples from 12 farms were examined during 2 successive spring and early autumn seasons. L. monocytogenes was isolated from vegetation or soil taken from 11 of the 12 farms and from 6 of the 7 nonagricultural sites. A total of 27 strains were iso-lated from the 19 sites. The organism was not isolated from any of the autumn collections.--Copy-right 1971, Biological Abstracts, Inc. W72-02537

ORGANIC MATTER AND MICROFLORA IN THE UNDERGROUND WATERS OF FERGANA (IN RUSSIAN),

Z. I. Kuznetsova, and V. M. Shvets. Temat Sb Vses Nauch-Issled Inst Gridrogeol Inzh Geol. 26. 30-69. 1970.

Identifiers: Bacteria, Fergana, Flora, Matter, Micro, Organic, Underground, USSR, Petroleum.

Results are given of determinations of organic matter and the microflora in 100 samples of underground waters taken from petroleum deposits and in the areas of supply and discharge. The sigand in the areas of supply and discharge. The significance of different groups of organic substances and bacteria is given with respect to their use in petroleum reconnaissance.--Copyright 1971, Biological Abstracts, Inc.

VIRUSES, A NEW POLLUTANT. State of Illinois, Lake Michigan and Adjoining Land Study Commission.

In: Report to the Governor and the 77th General Assembly, Vol II - Supporting Studies, October 1971, p 103-112. 6 ref.

Descriptors: \*Viruses, \*Human diseases, \*Public health, \*Pollutants, Diseases, Sewage treatment, Environmental sanitation, Human pathology, Chlorination, Test procedures, Water supply. Identifiers: \*Urban areas, Polio, Meningitis,

It is suggested that viruses represent a potential hazard to public health in urban areas. Briefly, viruses enter waterbodies through the discharge of inadequately treated sewage, these viruses can cause a variety of ailments when they enter the human body, and new techniques are being developed to detect and eradicate such viruses. Of sible types of viruses which might be found in waterbodies, those of greatest concern are the human pathogenic viruses which infect the digestive tract, e.g. polio, meningitis, and hepatitis. It has been suggested that sewage may be an important source of viral contamination of waterbodies. Many studies seem to indicate that conventional swage treatment processes and conventional use of these processes, which involve the use of chlorination, are not effective in destroying possible disease-causing viruses. Part of the difficulty in the past with evaluating the risk involved in viral contamination of waterbodies has been the inability to develop an adequate method of testing for viruses. (Davis-Chicago)

W72-02596

A CRITIQUE OF THE EFFECTIVENESS OF WATER QUALITY STANDARDS IN POLLUTION ABATEMENT.

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State of Illinois, Lake Michigan and Adjoining Land Study Commission.

In: Report to the Governor and the 77th General Assembly, Vol II - Supporting Studies, October 1971, p 1-30. 9 tab, 1 ref.

Descriptors: \*Water quality, \*Standards, \*Lake Michigan, \*Water pollution, \*Water analysis, \*Pollution abatement, Illinois, Effluents, Waste dilution, Waste water disposal, Waste water treatment, Water pollution control.

Identifiers: \*Chicago metropolitan area, \*Water quality criteria, \*Effluent criteria.

It is concluded that the water quality criteria of the State of Illinois are not well considered and are not rationally related to their avowed purpose. To some extent this may be remedied by more stringent standards. However, some rather difficult computations must be made concerning the present and future nature and amounts of effluents before one can be sure that water quality criteria would work. A simpler solution might be to set effluent criteria at the acceptable level for the lake water and not bother about making any average computations. This is a rather stringent require-ment but it may be the only workable way in the long run that water quality can be preserved. Two factors may make the stringent approach somewhat unwieldy. One must determine what parameters are to be measured in determining acceptable water quality. Also, in setting an acceptable level for each parameter, one must consider the complex interactions between various parameters, some of which might not be evident until an adverse effect has already been produced, e.g. mercury poisoning. A second alternative to typical water quality criteria would involve disposal of wastewater in lo-cations other than waterbodies. The costs of total disposal of wastes outside of waterbodies may be such that some sort of mixed approach may prove the best alternative. (Davis-Chicago) W72-02600

A METHOD OF DETERMINING RESIDUAL AMOUNTS OF AKRES, A NEW FUNGICIDE, IN CUCUMBERS AND DRINKING WATER (IN RUSSIAN),

All-Union Research Inst. of Hyg. Toxic. Pesticides, Polymers, Plastics, Kiev (USSR). A. M. Shmigidina, and M. A. Klisenda. Vop Pitan. 29 (5): 91-93. 1970.

Identifiers: Akrex, Chromatography, Cucumbers-D, Determining, Drinking, Fungicide, Layer, Method, New, Residual, Thin.

A method is proposed to determine residual amounts of Akrex, a new nitro phenol fungicide and acaricide, with thin-layer chromatography. It is based on the extraction of toxic chemicals with chloroform. A system of hexane-acetone solvents (4:1) was used. Powdered Zn was added to the composition of the silica gel then layer. Concentrated acetic acid was added to the color-forming agent. The percentage determination was 91 plus or minus 10.8 in cucumbers and 96 plus or minus 6.8 in water.—Copyright 1971, Biological Abstracts Les W72-02620

RAPID QUANTITATIVE METHOD FOR SAL-MONELLA DETECTION IN POLLUTED WATERS.

Wisconsin Univ., Madison. Food Research Inst. Chu Ming Cheng, William C. Boyle, and J. M. Goepfert.

Appl Microbiol. 21 (4): 662-667. 1971. Identifiers: Detection, Method, Polluted, Quantitative, Rapid. \*Salmonella.

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Identification of Pollutants-Group 5A

A procedure was developed for the enumeration of salmonellae in polluted waters using several modifications of existing techniques. Confirmation of salmonellae is achieved within 48 hr. This procedure includes selective enrichment in M-Tetrathionate includes selective enrichment in M-1 etratinonate
Broth (22 plus or minus 1 hr), plating on Brilliant
Green Sulfa Agar (20 plus or minus 1 hr), and confirmation by flagellar (H) agglutination of the
growth in a mannose-containing medium (6 plus or
minus 1 hr). An incubation temperature of 41.5C was used throughout this procedure. Dilution to extinction techniques (most probable number) were employed to enumerate salmonellae. Large sample volumes were concentrated through the use of membrane filters. This technique proved to be rapid and reliable for the enumeration of salmonellae in water, wastewater, and wastewater sludges.--Copyright 1971, Biological Abstracts, Inc. W72-02626

OXYGEN UPTAKE RATES OF BENTHAL SYSTEMS BY A NEW TECHNIQUE, Tufts Univ., Medford, Mass. N. B. Hanes, and R. L. Irvine. Proceedings Purdue Industrial Waste Conference, 21, May 3, 4, and 5, 1966. 4 tab, 8 fig, 21 ref.

Descriptors: \*Water quality, \*Oxygen demand, \*Benthos, \*Measurement, Self purification, Laboratory tests, Temperature, Oxygen sag, Decomposing organic matter.

During recent years, a great public awareness and concern of stream pollution and its associated problems has been evident. The benthal decomposition process, including oxygen uptake due to microbial respiration and its effects, has been recognized as part of this problem for many years.

A study was initiated to develop a simple procedure, requiring a minimum of time and equip-ment, to evaluate the total effect of benthal deposits on the oxygen balance of a stream. The ap-paratus consists of an airtight reaction chamber, Yellow Springs recorder, precision oxygen analyser, thermister, magnetic stirrer and stirring bar, petri dish, fine mesh aluminum screen, rubber stoppers and incubator. Benthal deposits are placed in the reaction chamber around the petri dish which contains the stirring bar and is covered with the fine mesh screen. Dilution water of known oxygen uptake is added to fill the chamber. Sensing elements are inserted through holes in the lid and the whole chamber is sealed. The incubator mainthe whole chamber is sealed. The includator maintains a constant reaction temperature. Preliminary tests indicate that: (1) the device is a potentially useful tool for measuring oxygen demand of benthal deposits; (2) the results are reproducible; (3) the rate of oxygen uptake decreases with temperature for old benthal deposits; and (4) the oxygen uptake rate decreases with temperature in the range 25-200 but not in the range 20-1500 for new benthal deposits. (Goesslins-Texas) benthal deposits. (Goessling-Texas) W72-02680

A COMPARISON OF MACROINVER-TEBRATES COLLECTED BY BASKET AND MODIFIED MULTIPLE-PLATE SAMPLERS, Upper Ohio Basin Office, Wheeling, W. Va. Richard W. Fullner.

J Water Pollut Contr Fed. 43 (3 Part 1): 494-499. Illus. 1971 (Fr., Ger., Port. and Span. summ). Identifiers: Basket, Collected, Invertebrates, Macro, Multiple, Plate, \*Samplers.

Benthic macroinvertebrates were collected on the Ohio River and several of its major tributaries from May to Oct. of 1968 using basket and modified multiple-plate samplers. Data are presented that compare the effectiveness of the 2 types of samplers. It was concluded from the study that the modified multiple-plate sampler is a more con-venient sampling device than the basket sampler and that it is comparable to the basket sampler for collecting benthic macroinvertebrates in large streams.--Copyright 1971, Biological Abstracts, W72-02689

MICROBIAL FLORA OF POND-REARED BROWN SHRIMP (PENAEUS AZTECUS),
Texas A and M Univ., College Station. Dept. of

Texas A and M Univ., College Station. Dept. of Animal Science. C. Vanderzant, R. Nickelson, and P. W. Judkins. Appl Microbiol. 21 (5): 916-921. 1971. Identifiers: Bacillus, Brown, Coryneform, Flayobacterium, Flora, Microbial, Micrococci, Moraxella, Penaeus-Aztecus, Pond, Pseudomonas, Reared, Shrimp, Vibrio.

Agar plate counts and microbial types are reported for brown shrimp reared in 2-acre natural marshland and in 0.5-acre artificial ponds during June to Oct. 1970. Bacterial counts of pond-reared shrimp ranged from 5 x 10000 to 5.5 x 1000000/g. At final harvest in Oct., bacterial counts ranged from 2 x 100000 to 5.5 x 1000000/g. In marsh ponds, bacterial counts of shrimp and pond water were lowest in Aug. when both water temperature and salinity were high. Coryneform bacteria and to a lesser extent Vibrio were the predominant isoa lesser extent vitorio were the predominant iso-lates from fresh pond shrimp. Shrimp stored at 3-5 C for 7 days were acceptable as judged by ap-pearance and odor. Between 7 and 14 days of refrigerated storage, bacterial counts increased sharply and about 50% of the samples became unacceptable. Refrigerated storage of pond shrimp caused increases in coryneform bacteria and micrococci and decreases in Vibrio, Flavobacterimicrococci and decreases in vibrio, Piavobacterium, Moraxella and Bacillus species. Pseudomonas species were not significant in fresh or stored pond shrimp. The microbial flora of pond water usually was dominated by coryneform bacteria, Flavobacterium, Moraxella and Bacillus species.—Copyright 1071. Biological Abstracts Inc. 1971, Biological Abstracts, Inc. W72-02691

A RAPID BIOCHEMICAL OXYGEN DEMAND TEST SUITABLE FOR OPERATIONAL CON-

TEST SCHOOL TROL,
California Univ., Davis. Dept. of Engineering.
Michael K. Mullis, and Edward D. Schroeder.
J Water Pollut Contr Fed. 43 (2): 209-215. Illus.

Descriptors: \*Biochemical oxygen demand. Identifiers: Activated, Biochemical, Control, Operational, Oxygen, Rapid, Sludge, Test, Waste, Water.

Operating parameters of the activated sludge process, including loading rate, reaction rate, cell yield, and sedimentation rate are used to make operational calculations. All of these require operational categories. All of these requires knowledge of the biological oxygen demand (BOD) being introduced into the process. The paper discussed a method of determining the total BOD of soluble wastes using the chemical oxygen demand (COD) test and a mass culture of cells. Experimental data and operational data are presented. A method of shortening the determination time is discussed. The total BOD seems to be a valid and useful technique. It is limited, however, by the characteristics of the COD test. Criteria for improving test sensitivity are given. The method should be useful for nonsoluble wastes other than domestic waste water.--Copyright 1971, Biological Abstracts, Inc.
W72-02709

PHOSPHORUS-33 AUTORADIOGRAPHY USED TO MEASURE PHOSPHATE UPTAKE BY IN-DIVIDUAL ALGAE,

New York State Dept. of Health, Albany. Div. of Labs. and Research.
G. Wolfgang Fuhs, and Edmondo Canelli.
Limnol Oceanogr. 15 (6): 962-966. Illus. 1970.

Identifiers: \*Algae, Auto, Centrifugation, Diatom, Filter, Individual, Lake, Measure, Membrane, Phosphate, Phosphorus-33, Phyto, Plankton, Radiography, Techniques, Uptake.

Diatoms from pure cultures and samples of lake phytoplankton were labeled with 33P, and au-toradiographs were prepared after concentration by centrifuge and membrane filter techniques. Conditions for labeling at a suitable intensity (1-3 dpm/1,000-micro 3 cell volume) were determined. The method is suitable for the detection of non-specific binding of P by organic materials and of differential P uptake by members of a mixed population. It also was used to determine continuity of P uptake in a cultured diatom.—Copyright 1971, Biological Abstracts, Inc.

A RAPID METHOD FOR ARSENIC ANALYSIS OF SOIL AND WATER BY ATOMIC ABSORP-

TION,
Air Force Armament Lab., Eglin AFB, Fla.
N. A. Hamme, A. L. Young, and J. H. Hunter.
Available from NTIS, Springfield, Va. 22151 AD728 628 - Price \$3.00 (Paper copy). Air Force Armament Laboratory Technical Report AFATLTR-70-107, October 1970. 13 p, 2 fig, 4 tab, 14 ref.

Descriptors: \*Pollutant identification, \*Arsenic compounds, \*Soils, \*Water, \*Spectrophotometry, Chemical analysis, Analytical techniques. Identifiers: \*Arsenic analysis, Atomic absorption.

One of the major herbicides used in military programs is dimethylarsinic acid (cacodylic acid). Its use in conjunction with an Air Force program of testing aerial spray equipment necessitated a rapid and accurate technique for the determination of arand accurate technique for the determination of approxi-senic in soil and water at concentrations of approxi-mately one part per million. The atomic absorption spectrophotometer was used. Ten-gram soil sam-ples were placed in 250-milliliter Erlenmeyer flasks and extracted with 20 milliliters of extracting solution (0.10N hydrochloric acid, 0.05N sulfuric acid, and 0.10 grams carbon black). The samples were mechanically shaken for five minutes and filtered. Up to 93.4% of the arsenic was recovered from soils to which known amounts of organic arsenic were added. By concentrating the water samples by a factor of 10 or more, arsenic could be determined down to 0.05 ppm. Comparison of standards made from inorganic arsenic dissolved in dilute nitric acid with standards prepared from cacodylic acid and with sodium cacodylate-cacodylic acid showed excellent correlation in the range from 0.5 to 40 ppm. The atomic absorption technique did not differentiate between organic and inorganic arsenic. (Woodard-USGS) W72-02751

THE DETERMINATION OF ACCURACY AND PRECISION LIMITS FOR TRITIUM IN WATER,

Environmental Protection Agency, Winchester, F. E. Knowles, Jr., and E. J. Baratta.

Radiological Health Data and Reports, Vol 12, No 8, p 405-409, August 1971. 4 fig, 6 tab.

Descriptors: \*Chemical analysis, \*Tritium, \*Pollutant identification, \*Methodology, \*Quality control, Analytical techniques, Standards, Water pollution control, Radioisotopes, Laboratory testa, Water quality.
Identifiers: \*Analytical methods (Tritium), \*Stan-

dard deviation.

The procedure is described for establishing a standard deviation value for analysis of tritium in water, and results of a technical experiment to test the validity of this value are discussed. Since many State, Federal and local laboratories are analyzing this radionuclide on a routine basis, a procedure of quality control to assist in producing comparable and accurate data is necessary. As more nuclear power reactors and nuclear fuel reprocessing plants become operative, tritium will be introduced into the environment in greater quantities. Therefore, other agencies are preparing for tritium analysis capability and will be depending upon this quality control program to assess equipment and sample preparation capabilities. A standard deviation of 10 percent for single determinations for values equal to or greater than 5 nanocuries per liter was established by assessing data from a tritium crosscheck program conducted by the Analytical Quali-

#### Group 5A-Identification of Pollutants

ty Control Service of the Office of Radiation Programs Environmental Protection Agency. The technical experiment results confirmed this value. (Woodard-USGS) W72-02765

COMPARISON OF MACROSCOPIC AND A COMPARISON OF MACROSCOPIC AND MICROSCOPIC INDICATORS OF POLLUTION, Oklahoma Univ., Univ. of Norman. Dept. of Civil Engineering; and Oklahoma Univ., Norman. Dept. of Environmental Science.

James D. Gallup, James M. Robertson, and Leale

Proc Okla Acad Sci. 50: 49-56. Illus. 1970. Identifiers: Bio, Diatoms, \*Indicators, Invertebrates, Macro, Macroscopic, Mass, Microscopic, Pollution, Streams, Test.

The most efficient parameter to assess pollution in streams receiving organic waste material is the benthic macroinvertebrate stream community. Benthic organisms are more fixed in habitat than are diatoms. Both groups of organisms can adequately express the state of a stream with respect to pollution. Diatoms are sensitive to waste and are immediately affected by it. Benthic organisms reveal both present and past environmental conditions, whereas diatoms reveal only present environmental conditions. Equations to express community diversity in the stream were evaluated. The simple biomass test was satisfactory in representing changes in stream conditions. The similarity index performed better than other indexes examined and, although somewhat difficult to produce, it may be the best way to compare stations on different streams because it can correlate the number of groups common to any 2 stations.— Copyright 1971, Biological Abstracts, Inc. W72-02785

ACTIVATION ANALYSIS OF POLLUTED RIVER WATER (IN JAPANESE), Radiation Center of Osaka Prefecture, Osaka

Tetsuo Mamuro, Yatsuka Matsuda, Akira Mizohata, Takayuki Takeuchi, and Akira Fujita. Radioisotopes. 20 (3): 111-116. Illus. 1971. En-

glish summary. Identifiers: \*Activation, Computer, Gamma-Ray, Mine, Polluted, River, Spectrometry, Tungsten, Waste water.

Instrumental neutron activation analysis by gamma-ray spectrometry with a high resolution Ge (Li) detector followed by spectrum analysis with an electronic computer was applied to elemental analysis of a river water sample which was collected in river water into which pour liquid wastes from a tungsten mine, and the concentrations of 31 elements were determined. Among the elements were some which are regarded as important environmental pollutants, such as Cd, As, Sn and Cr. Such instrumental neutron activation analysis is quite useful for elemental analysis of polluted river water. The presence of U was found by detecting 239Np. Fluorescence X-ray analysis revealed the presence of Mo and Sr, but the concentrations of these 2 elements could not be determined by the present activation analysis. The study was not limited to heavy metals. Information on the concentrations of many elements will be useful when comparing the elemental compositions of different river water samples and attempting to determine the characteristic quality of a polluted river; it therefore may provide basic data for establishing long term con-trol against river water pollution.—Copyright 1971, Biological Abstracts, Inc. W72-02786

PHYTOPLANKTON SAMPLING WITH THE

SEDGWICK-RAFTER CELL,
Darling (Ira C.) Center for Research Teaching and
Service, Walpole, Me.
For primary bibliographic entry see Field 07B.
W72-02792

BACTERIAL AND FUNGAL FLORA OF SEAGULL DROPPINGS IN JERSEY, Jersey General Hospital, St. Helier (England). J. Cragg, and Y. M. Clayton. Journal of Clinical Pathology, Vol 24, No 4, p 317-

Descriptors: \*Animal wastes (Wildlife), \*Bacteria, Fungi, Waste identification, E. coli, Streptococ-cus, Yeasts, Salmonella, Shigella, Seashores, Sampling, Laboratory tests, Gulls, Identifiers: \*Seagull, Mycology, Jersey.

In Jersey 166 fresh and 122 dried seagull droppings were obtained and studied locally and in London for the presence of bacteria and fungi of potentially pathogenic nature. There were no salmonella or shigella bacteria isolated from the two groups but there was a high proportion of Candida albicans obtained from the fresh material (21.7%) and only obtained from the fresh material (21.7%) and only 1.6% from the dry faeces. Cryptococcus neoformans and Histoplasma capsulatum were not found in either the dry or fresh droppings. The normal bacterial and fungal flora of the seagull was established and it is considered that the C. albicans in fresh gull droppings would not materially in-crease albicans infections in man. (Bundy-Iowa State) W72-02836

MODELING FEEDLOT RUNOFF POLLUTION I. ANALOG SIMULATION, Kansas State Univ., Manhattan. Dept. of Chemical

Ransas State Univ., Mannattan. Dept. of Chemical Engineering. S. F. Kang, L. T. Fan, E. S. Lee, and L. E. Erickson. Transactions of the American Society of Agricul-tural Engineers, Vol 13, No 6, p 858-869, Nov-Dec 1970. 11 fig, 3 tab, 26 ref. FWPCA WP-0141-02.

Descriptors: \*Farm waste, Confinement pens, Computer model, Analog computer, Analog models, Simulation analysis, Runoff, Water pollu-tion, Infiltration, Cattle.

Identifiers: \*Dimensional analysis, Dynamic modeling, Feedlot.

The purpose of the investigation outlined is to innamely, a dynamic model represented by a set of nonlinear differential equations using analog computer simulation. Since the feedlot runoff system does not generally remain at steady state, a dynamic model can represent the system more realistically than a static model. For a system of three parameters, fitting data by an analog simulation can be used effectively when high accuracy is not required. However, for a complex system with a large number of unknown parameters, the analog simulation approach can be very tedious and time consuming. The quasi-linearization technique is shown to be a useful tool for estimating parameters in a feedlot runoff system. The advantage of the quasilinearization technique is that, if the process converges, it converges quadratically. This technique has been proved useful not only in parameter estimation, but also in solving nonlinear boundary value problems in partial and ordinary differential equations. The quasilinearization technique also has disadvantages; two of the most important ones are the ill-conditioned problems and the convergence problem. (Bundy-Iowa State) W72-02846

A THIN-LAYER CHROMATOGRAPHIC PROCEDURE FOR THE DETECTION IN SOILS AND WATERS OF HERBICIDE RESIDUES COMMONLY USED IN SASKATCHEWAN, Regina Research Station (Saskatchewan).

Allan E. Smith, and Anne Fitzpatrick.
J Chromatogr. 57 (2): 303-308. Illus. 1971.
Identifiers: Canada, Chromatographic, Detection, Procedure, Herbicide, Layer, Saskatchewan, Soils.

A thin-layer chromatographic procedure has been developed for the rapid detection of 19 herbicides commonly used in Saskatchewan. Thus atrazine, barban, bromoxynil, dalapon, dicamba, diuron,

linuron, MCPA, MCPB, MCPP, monuron, picloram, simazine, trifluralin, 2,4-D, 2,4-DB, 2,4-DP, 2,4,5-T and TBA can be collectively detected in soils at the 1 ppm level and in natural waters at the 0.1 ppm level.--Copyright 1971, Biological Abstracts, Inc. W72-02924

FAECAL COLIFORM BACTERIA: IS A NATIONAL STANDARD APPLICABLE TO THE WELLINGTON AREA, Wellington City Corp. (New Zealand). I. L. Vidal, and A. A. Collins.

N Z J Mar Freshwater Res. 4 (4): 445-455. 1970.

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Identifiers: America, Applicable, Bacteria, Coliform, Fecal, Human, Method, National, New Zealand, North, Number, Probable, Recreational, Standard, Wellington (NZ).

The suggested new standard of recreational water is a median fecal coliform index of 200/100 ml with a maximum value of 400/100 ml. Fecal coliform sub-group bacteria are the best indicator of fecal pollution; the membership of this sub-group is men-tioned. Inherent inaccuracies of the Most Probable Number (MPN) method of assessing bacterial populations discussed, such as experimental varia-tions with different cultural media, and errors in interpretation of results. In N. AMERICA, AN MPN for the total coliform group of 1000/100 ml in-dicates a fecal coliform sub-group MPN of 200/100 ml. The usual ratio of fecal coliforms: coliform group bacteria is typically 1:1 in fresh and marine waters of the Wellington region; a more attainable standard would be 500 fecal coliforms/100 ml. In ratios quoted, 'coniform group' means the remainder of the coliform group excluding fecal coliforms. The ratio is different in other parts of New Zealand; in Auckland, for example, the ratio is close to that found in the USA .-- Copyright 1971, Biological Abstracts, Inc. W72-02933

AIRBORNE FLUORIDE IN THE LAKE ST. CLAIR: DETROIT RIVER AREAS. G. L. Waldbott.

Fluoride. 4 (2): 93-96. Map. 1971.

Identifiers: Airborne, Detroit, Fluoride, Gladiolus-M, Human, Lake, Monitor, River, Saint-Clair.

A study concerned with air pollution in the Lake St. Clair-Detroit River area was undertaken by a special board at the request of the 'International Joint Commission' representing the governments of USA and Canada. A limited survey for atmospheric F- yielded concentrations of 0.16 to 2.9 ppb. In comparison, the highest level obtained by the National Air Sampling Network in 1966 and 1967 was 2.4 ppb. Gladioli planted at 5 locations showed F-2.4 pp. Gladion planted at 3 locations snowed F-levels up to 50 ppm. Tip and margin burns oc-curred within 5 wk after the gladioli were planted. The sources of F- emission were not determined. Such variables as duration and continuity of sampling, heighth of sampling stations and their distance from the emitting sources, F- levels in soil and edibles grown in the respective area should be considered in order to apply the above findings to the evaluation of health effects of F- emissions upon humans.--Copyright 1971, Biological Abstracts. Inc. W72-02936

#### 5B. Sources of Pollution

THE RATE OF OXIDATION OF PETROLEUM PRODUCTS IN WATER WITHOUT ADDITION OF NITROGEN,

A. I. Iz'yurova. Available from the National Technical Information

Service, Springfield Va., 22151 as AD-729 183 for \$3.00 in paper copy, \$0.95 in microfiche. Ministry of Defence Naval Scientific and Technical Information Centre Report, 1971. 7 p, 2 tab. (Reprint from Gigiena i Sanitariya, vol 7, p 12-17, 1952 -Translation No 2474, July 1971).

#### WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Sources of Pollution-Group 5B

Descriptors: \*Water pollution sources, \*Oxidation, \*Oily water, \*Time, Nitrogen, Analytical techniques, Phosphorus, Oil-water Chemical reactions, Nutrients. Identifiers: \*Oxidation rate, Petroleum products.

The process of bacterial oxidation of petroleum products in water in the presence of an adequate quantity of phosphorus and potassium can take place without supplementary addition of nitrogen, apparently because of fixation of atmospheric nitrogen. When nitrogen, phosphorus and potassium are added, the oxidation of petroleum products on the surface of the water under laboratory conditions occurs within 1.2 months; without introductions occurs within 1-2 months; without introductions occurs within 1-2 months; without introduc-tion of nitrogen, the rate of oxidation is 4 times as slow. For slow rates of oxidation of petroleum products, for example when they are at the bottom of the vessel, the rate of oxidation in the presence of phosphorus and potassium does not depend on the addition of nitrogen. A lack of phosphorus (30 times less than necessary for a continuous process) times less than necessary for a continuous process) in the presence of the remaining nutrients gives rise to a reduction in the rate of oxidation of petroleum products in water by approximately 10 times. (Woodard-USGS)
W72-02257

EFFECTIVENESS AND PERSISTENCE OF BROMACIL AND KARBUTILATE APPLIED USING FIXED- AND ROTARY-WING AIR-

CRAFT,
Texas A and M Univ., College Station. Dept. of Range Science.
For primary bibliographic entry see Field 04A.
W72-02267

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CIRCULATION AND WATER MOVEMENT IN

Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch. For primary bibliographic entry see Field 02H. W72-02277

HYDROLOGY OF THE PLEISTOCENE SEDI-MENTS IN THEWYOMING VALLEY, LU-ZERNE COUNTY, PENNSYLVANIA, Geological Survey, Harrisburg, Pa. For primary bibliographic entry see Field 04B. W72-02303

ARECONNAISSANCE OF STREAMFLOW AND FLUVIAL SEDIMENT TRANSPORT, INCLINE VILLAGE AREA, LAKE TAHOE, NEVADA, FIRST PROGRESS REPORT, 1970, Geological Survey, Carson City, Nev. For primary bibliographic entry see Field 02J. W72-02329

PREDICTION OF WATER MOVEMENT THROUGH SOILS-A FIRST STEP IN WASTE TRANSPORT ANALYSIS, Batelle Memorial Inst. Richland, Wash. Pacific

R. W. Nelson, and J. R. Eliason. Proceedings, Industrial Waste Conference, 21st, May 3,4, and 5, 1966. p 744-758, 4 fig, 3 tab, 9 ref.

Descriptors: \*Groundwater movement, \*Mathematical models, \*Waste water disposal, Soil properties, Diffusion, Flow water, Forecasting, Water pollution sources, Path of pollutants. Identifiers: Hydrodynamic dispersion.

The balance between public health and economy of wastewater disposal can be realistically evaluated only by knowing prior to disposal the effects and hazards involved. Such evaluations should rest on a sound knowledge of basic scientific phenomena rather than intuitive and subjective observations and estimates. This paper relates recent theoretical advances in describing the flow of fluids in porous media to problems involving the transport of pollutants through soils. There are three broad phases of analysis involved in predicting contaminant transport through porous media: Macroscopic fluid flow; Microscopic flow; and, Reactions of contaminants with the media. Only the first phase is discussed in detail here. Macroscopic flow analysis considers the large effects of the flow system such as paths of flow, flow rates, velocity distribution, travel times and any other physical aspect of interest in the macroscopic flow system. The various elements of macroscopic flow systems are discussed and their impact on problem of water transport through soil systems are presented. The result of this mathematical formulation is a model result of this mathematical formulation is a model which allows the prediction of arrival time of water injected at a given point at another specified point in the system. The relationship between this paper and other phases of analysis is discussed. (Goessling-Texas) W72-02415

THE ROLE OF BENTHOS AND PLANKTON STUDIES IN A WATER POLLUTION SURVIEL-LANCE PROGRAM, Robert A. Taft Sanitary Engineering Center, Cin-

cinnati, Ohio.
For primary bibliographic entry see Field 05A.
W72-02419

SURVEILLANCE FOR CHLORINATED HYDROCARBON PESTICIDES IN SURFACE

Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. For primary bibliographic entry see Field 05A. W72-02421

FIRST REPORT OF THE LAKE MICHIGAN, AND ADJOINING LAND STUDY COMMISSION OF THE STATE OF ILLINOIS.

State of Illinois, Lake Michigan and Adjoining Land Study Commission. For primary bibliographic entry see Field 05G. W72-02459

NITRATE CONTAMINATION OF GROUND WATER IN THE NEEPAWA-LANGRUTH AREA
OF MANITOBA,
Manitoba Univ., Winnipeg. Dept. of Soil Science.

R. A. Hedlin.

R. A. Tiedilli. Can J Soil Sci. 51 (1): 75-84. Illus. 1971. Identifiers: Canada, Contamination, Globinemia, Ground, Hemo, Infant, Langruth, Manitoba, Met, Neepawa, Nitrate, Ruminant.

Reports of methemoglobinemia of bottle-fed infants and nitrate poisoning of ruminants prompted an investigation of the cause and distribution of high levels of nitrate in ground water. The problem was of common occurrence in areas where surface deposits consist of about 2-4 m of sandy-textured material overlying less permeable lacustrine clay or clay loam till. Although appreciable amounts of nitrate move to the ground water in fallow fields, a very high nitrate concentration occurs only in and around farmstreads or in the vicinity of towns and villages where human and animal wastes are concentrated. Ground water in the sites investigated moved laterally in a northeasterly direction, and a dilution of nitrate was observed in the slowly moving ground water to a level of less than 10 ppm within about 1/10 km in that direction. In contrast, ground water closely adjacent to the western and southern boundaries of the farmsteads, being up-grade from the source of contamination, was free from toxic quantities of nitrate .-- Copyright 1971, Biological Abstracts, Inc. W72-02510

METHYLMERCURY: HALF-TIME ELIMINATION IN FLOUNDER, PIKE AND

Helsinki Univ. (Finland). Dept. of Radiochemistry. T. Jarvenpaa, M. Tillander, and J. K. Miettinen. Suo Kem B. 43 (11): 439-447. Illus. 1970.

Identifiers: Anguilla-Vulgaris, Eel, Elimination, Esox-Lucius, Flounder, Gamma, Half-Time, Mer-cury, Methyl, Pike, Pleuronectes-Flesus, Spec-trometer.

203Hg-labelled methymercury, as the ionic form nitrate, and as a protein-bound form, was applied perorally, and as the ionic form, injected i.m. to 3 pecies of fish, flounder (Pleuronectes flesus), (Esox lucius) and (Anguilla vulgaria) and its rate of elimination was determined by 'whole-body counting' the live fish for 100 days in a gamma spectrometer. Both forms of methylmercury gave flounder and pike rather similar half-times, between 640 and 780 days, but i.m. injection gave to flounder, 1.200 plus or minus 400 days. For eel, the proteinate gave perorally 910 days, the ionic form both perorally and i.m., 1.030 days.—Copyright 1971, Biological Abstracts, Inc. W72-02517

DIURNAL VARIATIONS IN THE PHYSICOCHEMICAL CHARACTERISTICS OF DIURNAL SEWAGE AT JAIPUR, Central Public Health Engineering Research Inst.,

Central Public Health Engineering Research Inst., Nagpur (India). K. L. Saxena, R. S. Nagabushana, P. Kurmaran, M. S. Olaniya, and W. G. Nawlakhe. Environ Health. 12 (4): 311-322. Illus. 1970. Identifiers: Diurnal, India, Jaipur, Physiochemical,

Sewage, Variations.

The variations in flow and quality of sewage from the Southern Sewage Farm and the Northern Farm were studied. The coefficients of fluctuation in flow, BOD (biological oxygen demand) and suspended solids for sewage at the Southern and the Northern Sewage Farms were 0.51, 698, 527 ppm and 0.63, 483ppm, 410 ppm respectively.--Copyright 1971, Biological Abstracts, Inc. W72-02522

CALCULATION OF SUBSTANCES IN RIVERS BY A FEW SINGLE ANALYSES IN COM-PARISON TO CONTINUAL CHEMICAL STU-DIES OVER A PERIOD OF ONE YEAR, DEMONSTRATED ON THE ARGEN RIVER, A TRIBUTARY OF LAKE CONSTANCE, (IN GER-

MAN), Staatl Institut fuer Seenforschung und Seenbe-wirtschaftung, Langenargen (West Germany).

Schweiz Z Hydrol. 32 (2): 453-474. Illus. 1970. English summary

Identifiers: Analyses, Argen, Calculation, Chemical, Chloride, Constance, Continual, Germany, Lake, Nitrate, Organics, Over, Period, Relation-ship, River, Rivers, Substances, Tributary, West,

From May 1967 to May 1968 samples were taken from the mouth of the Argen River. Within 24 hr periods, sample-bottles were replaced. P, ammonia, nitrate, organic nitrogen in solution, chloride and the organic matters (oxidizable by permanganate) were analyzed; on the basis of these the reach the defer the permanent of the period of the permanent the yearly loads of substances were calculated. The relation between transported substances and water level was studied: high water of about 60 m3/s oc-curred only on 9 days during the whole year and transported about 20% of the total load of subtransported about 20% of the total load of sub-stances, except nitrate and chloride. At the same time the water-freight was only 10.3% of the amount during the year, nitrate and chloride were nearly the same. At low and middle water, increas-ing water-levels also caused much higher concentrations and loads of substances than normal. The influence of wastewater produced 2 maxima of pollution weekly, a greater one on Fridays and Satur-days and a smaller one on Tuesdays and Wed-nesdays; were found on Sundays. Comparative studies show that the yearly loads of substances can-not be calculated on the basis of the water discharge-line, known through long years of mea-surements. The loads cannot be calculated by analyzing only a few unspecified samples. To calcu-late the yearly loads a new method was developed.

#### Group 5B-Sources of Pollution

On the basis of this, 10 to 20 samples/yr suffice to calculate the yearly loads of substances with a margin of error of below 10%. Samples must be analyzed at all characteristic water-levels, especially during high water situations.--Copyright 1971, Biological Abstracts, Inc.

THE VALUE OF STREPTOCOCCUS FAECALIS AS AN INDICATOR BACTERIUM IN HEAVILY POLLUTED WATER.

Copenhagen Univ. (Denmark). Inst. of Hygiene. E. Fjerdingstad. Schweiz Z Hydrol. 32 (2): 429-438. 1970.

Identifiers: Bacterium, Growth, Heavily, Indicator, Polluted. Streptococcus-Faecalis, Streptococcus-Faecium.

Experiments on cultivation in various media, and under various experimental conditions of S. faecalis isolated from heavily polluted localitites are described. It is probable that it is not the high incubation temperature (45 C) which is the reason for the low counts found on cultivation in standard sodium-azide medium, but the fact that S. faecalis which has been adapted to growth in sodiumazide medium cannot-or can only with difficulty-grow when transferred into MacConkey medium (confirmatory test). Hajna's BAGG medium, which contains glycerol, is the only tested medium which yields reliable counts from heavily polluted localities. In experiments with identification tests to separate the 2 human streptococci S. faecalis and S. faecium, strains often failed to grow under one or more of the tolerance conditions. In routine work, streptococci growing at incubation tempera-tures of 10 and 45 C may be considered identical S. faecalis and those at 10 and 50 C as identical to S. faecium .-- Copyright 1971, Biological Abstracts, Inc W72-02528

THERMAL LOADING IN THE MARINE DIS-

TRICT, New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 05C. W72-02530

SANITARY BACTERIOLOGICAL INVESTIGA-TIONS OF THE COASTAL SEA WATER AROUND THE NORTH SEA ISLAND OF SYLT,

(IN GERMAN), Kiel Univ. (West Germany). Institut fuer Bioklimatologie und Meeresheilkunde.

J. Peters. Helgolaender Wiss Meeresunters. 21 (3): 310-319.

Maps. 1970. English summary. Identifiers: Bacteriological, Coastal, Escherichia-Coli, Island, North, Recreation, Sanitary, Sea, Sylt.

The island of Sylt is one of the most important recreation centers in the German part of the southern North Sea. As in other islands, the sewage of its several villages is led directly into the sea area ('Wattenmeer') between the island and the continental coast. During 1967 and 1968 the occurrence of sewage pollution at the beaches was examined. In order to estimate the water quality for bathing, the sanitary water control in Germany conventionally determines certain chemical quali ties as well as the general number of bacteria and the coli-titer of the water samples. Around the island of Sylt testing of 225 samples revealed that the upper limit of the bacterial number and of the coli-titer is not reached, neither at the open sea beach (bathing site), nor at the 'Wattenmeer' coast, except in narrow districts left and right of the sewage outlets of the 4 sewage plants. Comparison of the coli-titer of samples taken synchronously at different points of the coast show that there is of ously a tidal drift of sewage-contaminated waters from the 'Wattenmeer' to the open sea beach. Seasonal differences exist between general bacterial number and concentration of coli bacteria. The general number of bacteria depends on the concentration of organic matter in the water while the absolute number of sewage bacteria can be estimated by means of the coli-titer only. The capacity of self-purification of sea water manifests itself in the abundance of its bacteria (mostly endemic marine forms). Escherichia coli and the coli-form bacteria, however, are real sewage bacteria; their numbers must be carefully checked, since they indicate that human pathogenic bacteria may be present in the water as well.--Copyright 1971, Biological Abstracts, Inc. W72-02533

COLIFORMS AND FECAL COLIFORMS IN AN

OYSTER-GROWING AREA,
Food and Drug Administration, Dauphin Island, Ala., Gulf Coast Technical Service Unit. Maynard W. Presnell, and John J. Miescier

J Water Pollut Contr Fed. 43 (3 Part 1): 407-416. Map. 1971. Identifiers: Bayou, Coliforms, Commercial, Fecal,

Food, Growing, Oyster, Salmonella.

A study was conducted of the levels, possible sources, and sanitary significance of coliform and fecal coliform bacteria in water, soil, bird and animal feces in an oyster-growing bayou. Soil sam-ples and all fecal samples also were examined for Salmonella. Coliform and fecal coliform organisms were present in water and soil from obviously polareas and in areas classed as unpolluted in a recent sanitary survey. High coliform counts in soil samples indicate that the soil may serve as a reserthat contributes to the coliform and fecal coliform count of adjacent waters. Coliform counts of bayou waters were of such magnitude that the waters would have been unsuitable for harvesting of oysters for marketing. If animals and birds are or oysters for marketing. It animas and ordes are observed near shellfish-growing waters, an intensive bacteriological study of shellfish and water quality should be conducted.—Copyright 1971, Biological Abstracts, Inc.

W72-02536

INCIDENCE OF INFECTIOUS DRUG RE-SISTANCE AMONG FECAL COLIFORMS ISO-LATED FROM RAW SEWAGE,

Alabama Univ., Birmingham Medical Center. Alton B. Sturtevant, Gail H. Cassell, and Thomas

W. Feary. Appl Microbiol. 21 (3): 487-491. 1971. Identifiers: Ampicillin, Coliforms, Drug, Escherichia-Coli, Fecal, Incidence, Infect-Drugs, Infectious, Isolated, Raw, Resistance, Sewage, Streptomycin, Tetracycline

Raw sewage was examined for the incidence of antibiolic-resistant coliforms present among both total and fecal coliforms. In both groups, approximately 3% of the coliform bacteria were resistant to 2 or more antibiotics. Of these organisms, 48% were capable of transferring all or part of their antibiotic resistance to an antibiotic sensitive. Fderivative of Escherichia coli K-12. Among the R factors identified, those conferring resistance to streptomycin-tetracycline, ampicillinstreptomycintetracycline, and ampicillin or ampicillin-strepto-mycin accounted for 23, 20, and 15%, respectively, the total R factors detected. Data indic nificant level of infectious drug resistance among the fecal coliforms of the urban population. Because of the high incidence of coliform bacteria found to be doubly resistant to streptomycin and tetracyline, the inclusion of these antibiotics in selective media used for routine total or fecal coliform counts may serve to identify domestic sources of pollution.--Copyright 1971, Biological Abstracts, Inc. W72-02538

EFFECT OF THE HARDNESS OF WATER AND THE PROPERTIES OF THE SOIL ON THE HERBICIDAL ACTIVITY OF 2,4-D (SODIUM SALT), (IN RUSSIAN),

Lvov Agricultural Inst. (USSR). Y. T. Korobenchko. Agrokhimiya. 5. 109-112. 1970. Identifiers: Control, D, Hardness, Herbicidal, Salt, Sodium Soil Weed

In a solution with polyvalent metals, 2,4-D (Na salt) changes into the inactive forms and loses its sati) changes mis the martie forms and roses in herbicide properties. In hard water, a higher dose should be used, or Cabinding substances (e.g. am monium oxalate) may be added. The addition of ammonium oxalate at 50-100 g/100 I of water prowides the complete binding of Ca into the inactive form. In Ca-rich soils weeds are less susceptable to this herbicide. On carbonate soils the doses of 2,4-D should be greater than those used on acidic soils.—Copyright 1971, Biological Abstracts, Inc. W72-02545 gas. (hu bon sub nap teri basi esti

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ROLE OF HUMIC CARRIER SUBSTANCES IN DDT MOVEMENT THROUGH FOREST SOIL, British Columbia Univ., Vancouver. Dept. of

Forestry. T. M. Ballard.

Soil Sci Soc Amer Proc. 35 (1): 145-147. 1971. Identifiers: Carrier, DDT, Forest, Humic, Humus, Insecticide, Lysimetry, Movement, Soil, Substances.

In DDT-treated forest floor columns, over 30 times as much DDT was recovered by leaching with water when urea was added to disperse the humic acids. Using similar treatment and analysis, alundum tension lysimeters in soil 2 cm below the forest floor yielded no detectable levels of DDT. In DDTtreated humic extracts, 91% of added o,p'-DDT was recovered in humic acids and 9% in fulvic acids plus water.--Copyright 1971, Biological Abstracts, W72-02546

SALT-FLUORIDATION URINARY FLUORIDE EXCRETION Cantonal Hospital, Aarau (Switzerland).

Caries Res. 5 (1): 89-95. Illus. 1971. Identifiers: Caries, Excretion, Fluoride, Protection, Salt, Urinary.

Urinary fluoride excretion under different conditions was examined using a fluoride ion activity electrode. The mean 24-hr urinary fluoride excretin in adult women was 0.89 mg in Basel, Switzerland, with water-fluoridation at the 1ppm level. In 2 women using a domestic salt with 250 mg F/ THE MEAN FLUORIDE EXCRETIN WAS F/ THE MEAN FLUORIDE EXCRETIN WAS 1.04 mg and in 3 persons working in a children's home using the same salt it was 1.19 mg. a packeted salt with 250 mg F/kg should produce about the same cariesprotective effect as waterfluoridation. With salt-fluoridation the urinary at the control of the c fluoride concentration reaches its maximum 2-4 hr after a meal. In the urine of newborn boys the mean fluoride concentration was 0.08 ppm compared with 0.58 ppm in the post partum urine of their mothers, confirming the placental F-barrier.--Copyright 1971, Biological Abstracts, Inc. W72-02547

FEATURES OF DISTRIBUTION AND OIL-E-XPLORATION IMPORTANCE OF THE OR-GANIC SUBSTANCES AND MICROFLORA IN UNDERGROUND WATERS OF FERGANA AND BUKHARO-KHIVINSK OIL AND GAS RE-

BURHARO-HIVINSA OIL AND GAS RE-GIONS, (IN RUSSIAN), Z. I. Kuznetsova, and V. M. Shvets. Temat Sb Vses Nauch-Issled Inst Gidrogeol Inzh Geol. 16. 105-136. 1970.

Identifiers: Acids, Bacteria, Bukharo, Carbon, Carbons, Distribution, Exploration, Fergana, Flora, Gas, Humus, Hydro, Khivinsk, Micro, Naphthenic, Oil, Organic, Resins, Substances, Underground,

An assessment is given of the content of organic carbon, naphthenic acids, fatty acids, humus, resins, and hydrocarbons in underground waters for use as indicators in estimating the prospects of finding gas and petroleium deposits in large areas and for reconnaissance for petroleum and natural

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Sources of Pollution—Group 5B

gas. Indicators for such searches may be fatty acids (hundreds of mg or g/l) and petroleum hydrocar-bons (more than 20-25% of the total fluorescent bons (more than 20-25% of the total fluorescent substances). Indicators for petroleum are naphthaline-oxidizing and sulfate-reducing bacteria; for gas, heptane-oxidizing bacteria. On the basis of these indicators of petroleum and gas, an estimate is given of the probability of the occurence of petroleum and gas deposits in Fergana and Bukharo-Khivinsk oblasts.—Copyright 1971, Biological Abstracts, Inc.

ECOLOGICAL STUDIES ON YEASTS IN THE

ST. LAWRENCE RIVER, Laval Univ., Quebec. Dept. of Agriculture. R. E. Simard, and A. C. Blackwood. Can J Microbiol. 17 (3): 353-357. Illus. 1971. Identifiers: Bacteria, Biological, Canada, Coliforms, Depth, Dissolved, Ecological, Oxygen, Pollution, Rhodotorula-Glutinis, River, Salinity, Sewage, St-Lawrence, Temperature, Yeasts.

The total number of yeasts, bacteria, and coliforms found at 5 stations in the St. Lawrence River, sampled during a 5-month period in the summer of 1968, were compared to temperature, depth, biological oxygen demand (BOD), dissolved oxy gen (DO), and salinity. Averaged data indicate some relationships exist among the biological and physical parameters but examination of the data for the individual samples do not lead to the same con-clusions. The large increase in numbers of Rhodo-torula glutinis (the dominant species of the 'pink yeasts') followed the decrease in bacterial num-bers, both total count and coliforms, after the innors, our total count and conforms, after the introduction of sewage pollution. The metabolic characteristics of these 'pink yeasts,' allowing them to show such rapid increases in numbers, are not known.—Copyright 1971, Biological Abstracts, Inc. W72-02582

ECOLOGICAL STUDIES IN THE PLANKTON OF CERTAIN FRESHWATER PONDS OF HYDERABAD-INDIA: I. PHYSICO-CHEMICAL

Osmania Univ., Hyderabad (India). Dept. of Botany. For primary bibliographic entry see Field 05C. W72-02585

ORGANIC MATTER AND MICROFLORA IN THE UNDERGROUND WATERS OF FERGANA

For primary bibliographic entry see Field 05A. W72-02586

URBAN RUNOFF IN LAKE COUNTY, IL-

LINOIS. State of Illinois, Lake Michigan and Adjoining Land Study Commission.

In: Report to the Governor and the 77th General Assembly, Vol II - Supporting Studies, October 1971, p 73-101. 8 tab, 19 ref.

Descriptors: \*Runoff, \*Cities, \*Pollutants identifi-cation, \*Lake Michigan, \*Biochemical oxygen de-mand, Pollutants, Urbanization, Runoff forecasting, Sewage treatment, Land use, Phosphates, Il-linois, Suspended load.

linois, Suspended load. Identifiers: \*Lake County Illinois, \*Urban runoff, \*Suspended solids, \*Urban areas, Chicago metropolitan area.

An attempt is made to quantify the amount of vari-ous pollutants which may reach Lake Michigan as a result of runoff from urban areas in Lake County, Illinois and to compare these quantities with those which reach the lake in effluents from sewage treatment plants in the same area. Various complex interrelationships between runoff and sewage treatment plants with regard to storm water are outlined. Physical factors-geography, precipitation, and land use--are described together with a summary of existing sewage treatment practices. Sufficient data was available to compose two parameters, BOD and suspended solids. It was estimated that BOD and suspended solids. It was estimated that runoff usually accounted for approximately 80% of the total suspended solids and 12% of the total BOD released to Lake Michigan, the remainder coming from sewage treatment plant discharges. However, during periods of rainfall, the percentage of BOD resulting for support of the percentage of BOD resulting for support of the percentage. of BOD resulting from runoff is greatly reduced. It is also concluded that accepted figures for the quantity of phosphate contributed by urban runoff to Lake Michigan appears to be significantly low. (Davis-Chicago) W72-02597

SEWAGE DISPOSAL IN CHICAGO, PAST DECISIONS AND FUTURE PROSPECTS.

State of Illinois, Lake Michigan and Adjoining Land Study Commission.
For primary bibliographic entry see Field 06B.
W72-02598

MECHANISM FOR THE WATER-TO-AIR TRANSFER AND CONCENTRATION OF BAC-

TERIA, State Univ. of New York, Albany. Atmospheric Sciences Research Center.

Duncan C. Blanchard, and Lawrence Syzdek.

Science (Washington). 170 (3958): 626-628. Illus.

\*Bacteria, Concentration, Identifiers: Air, Mechanism, Transfer.

Air bubbles breaking at the air-water interface can remove bacteria that concentrate in the surface microlayer and eject the bacteria into the at-mosphere. The bacterial concentrations (numbers/ml) in the drops ejected from the bubble may, depending on drop size, be from 10-1000 times that of the water in which the bubbles burst..-Copyright 1971, Biological Abstracts, Inc. W72-02631

ISOLATION OF SALMONELLA IN SEWAGE WATER IN TANANARIVE,

Service de Sante des Armees, Tananarive (Madagascar).

Pierre Coulanges, and Andre Mayoux. Arch Inst Pasteur Madagascar. 39 (1): 35-39.

Identifiers: Cycle, Fly, Human, Isolation, Madagascar, \*Salmonella, Salmonella-Anatum, Salmonella-Manhattan, Salmonella-Muenster, Salmonella-Typhimurium, Sewage, Tananarive,

During the spring and summer of 1960-70, a study on 44 samples of sewage water from Tananarive demonstrated 8 Salmonella strains belonging to 4 different serotypes: S. anatum, S. typhimurium, S. manhatten and S. muenster. Some of them were found in flies, completing and confirming the water-vector-human cycle.--Copyright 1971, Biological Abstracts, Inc. W72-02632

SEASONAL VARIATION AND DISTRIBUTION OF 65ZN, 34MN, AND 51CR IN TISSUES OF THE CRAB CANCER MAGISTER DANA,

Oregon State Univ., Corvallis. Dept. of Oceanog-

David A. Tennant, and William O. Forster. Health Physics, Vol. 18 (June), p. 649-657, 1969, 8 fig, 2 tab, 30 ref.

Descriptors: \*Radioisotopes, \*Nuclear reactors, \*Water pollution sources, Chromium, Manganese, Toxicity, Sampling, Adsorption, Metabolism, Analytical, Techniques, Water quality control, Identifiers: \*Specific activity.

Crabs were collected from the Columbia River estuary during 1966-67, and their tissues were analyzed for both stable and radioactive Cr, Zn, and Mn. Levels of radioactivity (pCi radionuclide/g and Mn. Levels of radioactivity (PCI radionuclider) ash) and total element concentrations (micro g element/g ash) were determined for the various tissues and specific activities (ratio of radio-activity to concentration of total nuclide) were calculated-Chromium-51 and Zinc-65 accounted for nearly all the gamma radioactivity in the tissues, the Zn-65 being mainly concentrated in soft tissues and the Cr-51 in the hard tissues. Manganese-54 concentrations were highest in the setae and calcareous exoskeleton, presumably because of surface adsorbed 54MnO2. Specific activities and radioactivities fluctuated throughout the year in much the same manner, with maximum radioactivities seemingly related to river discharge and peak specific activities due to metabolic changes in the crab. Specific activities suggest that surface adsorbed radionuclides are turned over faster than in-ternally adsorbed radionuclides. (Lowry-Texas) W72-02662

STATISTICAL ASSESSMENT OF DO IN NAVIGATION POOL, Illinois State Water Survey, Peoria.

Thomas A. Butts, Ralph L. Evans, and Donald H.

Schnepper.
Proceedings of the ASCE, Journal of the Sanitary
Engineering Division, Vol 96, No. SA 2, p 477-500,
April 1970, 18 fig, 7 tab, 9 ref.

Descriptors: \*Dissolved oxygen, \*Sampling, \*Statistical analysis, Temperature, Flow rates, Nitrification, Monitoring, Computers, Water quali-ty control, Biochemical oxygen demand. Identifiers: \*Time-of-travel, \*LaGrange Naviga-

Samples of water were taken from both the LaGrange navigation pool, and the mouths of rivers which are tributary to the pool, over a three year period and analyzed for dissolved oxygen and biochemical oxygen demand. Temperatures were also recorded at each sampling point, and both flows and time-of-travel were calculated. Because the pool operates mainly as a hugh holding tank during intermediate to low flows, and also the presence of much non-uniformity in the flow, time of travel, rather than flow, was chosen for use in developing the DO prediction equations. Alogarithmic regression equation was developed relating the computer calculated times to the gaged flows at Kingston Mines, Qk and Meredosia, Qm. For low sumner flows, average and minimum DO concentrations were reliably predicted using the regression equation. First stage BOD was not in-dicated as a major source of dissolved oxygen con-sumption, but nitrification appeared to be a significant cause. A water quality chart design, ideally suited for data input generated by a continuous water monitor, was proposed. (Lowry-Texas) W72-02667

BIOSTIMULATION AND ALGAL GROWTH KINETICS OF WASTEWATER, Utah State Univ., Logan. Dept. of Civil Engineer-

ing.
E. J. Middlebrooks, D. B. Porcella, E. A. Pearson. P. H. McGauhey, and G. A. Rohlich.

J Water Pollut Contr Fed. 43 (3 Part 1): 454-473. Illus. 1971 (Fr., Ger., Port. and Span. summ).
Identifiers: \*Algal, Bio, Growth, Kinetics, Lake,
Minerals, Stimulation, Tahoe, Toxicity, USA,

An investigation was made of the biostimulatory characteristics and algal growth potential of waste-water effluents and surface runoff in Lake Tahoe. Specific parameters studied were the maximum growth rate and the maximum cell concentration for waters that have undergone various degrees of tor waters that have undergone various degrees or treatment. Growth rates increased linearly with total N, and algal growth approached a maximum rate at an initial total P concentration of 50 micro gll. All types of wastewater effluents apparently are toxic to algal growth in the assay used, and deviations from the expected growth response predicted by N and P concentrations could be caused by the

#### Group 5B-Sources of Pollution

presence of toxicants. All effluents could be ex-Tahoe.—Copyright 1971, Biological Abstracts, Inc. W72-02690

PROLONGED SALMONELLA CONTAMINA-TION OF A RECREATIONAL LAKE BY RU-NOFF WATERS, Wisconsin Univ., Madison. School of Medicine.

David G. Claudon, Donald I. Thompson, Eleanor H.Christenson, Gerald W. Lawton, and Elliot C.

Appl Microbiol. 21 (5): 875-877. 1971. Identifiers: Contamination, Lake, Mendota, Recreational, Runoff, Salmonella, Wisconsin.

In the summer and fall of 1968, various Salmonella serotypes were isolated from a portion of Lake Mendota, the major recreational lake for Madison, Wisconsin. The apparent source of these organisms was a residential storm sewer and a University of Wisconsin Experimental Farms' washwater drain. Salmonellae were isolated with regularity from a swimming beach located approximately 0.5 mil. (0.8 km) from these sources .-- Copyright 1971, Biological Abstracts, Inc. W72-02705

PESTICIDES IN AIR: VOLATILIZATION OF SOIL-APPLIED DDT AND DDD FROM SOIL-APPLIED DDT AND DDD FROM FLOODED AND NONFLOODED PLOTS, Agricultural Research Service, Baton Rouge, La. Soil and Water Conservation Research Div. G. H. Willis, J. F. Parr, and S. Smith Pestic Monit J. 4 (4): 204-208. Illus. 1971.

Descriptors: \*DDT, \*DDD. Identifiers: Air, Applied, Climatic, Condition, Flooded, Nonflooded, Pesticides, Plots, Soil, Volatilization.

A misture of 42% DDT and 16% DDD was incorporated into Commerce silt loam to a 6-in. depth and also surface-applied to achieve an average con-centration of 42.3 ppm of DDT and 16.2 ppm of DDD. Atmospheric concentration gradients and cumulative recovery for each pesticide were then monitored continuously for 6 mo. at 10 and 30 cm above the water or soil surface of uncropped, flooded and nonflooded plots. Within the 1st 2 days the atmospheric concentration of DDT at 10 cm dropped from a maximum value of 1977 to 48 ng/m3 above the flooded plot and from 2041 to 100 mg/m3 above the nonflooded plot, while corresponding levels of DDD decreased from 405 to 30 mg/m3 and from 575 to 92 ng/m3, respectively. Concentrations at 30 cm were comparatively lower throughout the study, denoting the existance of concentration gradients which were easily characterized. Except for the 1st few days following appli-cation, pesticide concentrations at either height seldom exceeded 100 ng/m3. Subsequent changes in the atmospheric concentration of the pesticides appeared to be related to climatological factors. The higher atmospheric concentration and cumulative recovery of DDT compared with DDD ap-parently reflected the relative amounts of each pesticide in the original mixture, although other possibilities are discussed. It is evident that the flooding treatment effectively retarded the volatilization of both pesticides.—Copyright 1971, Biological Abstracts, Inc.

POLLUTION BY COLI-FORM GROUP BAC-TERIA IN SEA WATER OF SWIMMING RESORTS: I, (IN JAPANESE),

Chiba Sch. Pharm. Assoc. (Japan). Shoichi Yamanaka, Daiji Mizuno, Shigeru Ishii, Maki Hayashi, and Tsutomu Unemoto. J Hyg Chem. 16 (5): 281-283. Illus. 1970. English

summary. Identifiers: B, Bacteria, Bactericidal, \*Coliform, \*Escherichia-Coli, Group, Pollution, Resorts, Rivers, Sea, Sewage, Swimming, Water.

Water pollution at Tateyama beach (Chiba Prefecture) by coliform bacteria was examined. Sea water has a bactericidal activity against Escherichia coli B. The linear correlation coefficient, calculated between the concentration of halogen ions and the logarithmically transformed MPN (most probable number) value for coliforms was-0.774 (N-10) and was clearly significant at the 1% level. The extent of pollution by these bacteria being introduced by rivers and sewage seemed to be mainly affected by the bactericidal nature of the sea water, in addi-tion to dilution.--Copyright 1971, Biological Ab-W72-02724

NITRATE TRANSFORMATION IN PEAT. Technion - Israel Inst. of Tech., Haifa For primary bibliographic entry see Field 02K. W72-02729

MAN AND HIS ENVIRONMENT, VOL. 1, M. A. Ward.

Pergamon Press: Elmsford, N.Y., Symposium. 196 p. 1970. \$12.00. Identifiers: Air, Book, \*Environment, His, Man, Pollution, Symposium, Water.

This volume in the new series contains the 17 invited papers presented at the 1st Banff Conference on Pollution sponsored jointly by the University of Calgary and the Engineering Institute of Canada, held May 16-17, 1968, at the Banff School of Fine Arts, Alberta. The topics deal with air and water pollution, of interest to those involved with pollution problems at industrial, governmental and university levels. Governmental control, engineering problems in management, sources and types of pollution of water are considered, citing specific accounts and projects. Also discussed in the air pollution and urban waste areas are sources, meteorology, types, management and engineering, health effects and future planning.—Copyright 1971, Biological Abstracts, Inc.

WATER QUALITY OF THE SOVIET UNION - A REVIEW

Office of the Surgeon General (Army), Washing-For primary bibliographic entry see Field 05C. W72-02770

CRITERIA NEEDED TO DESIGN ANIMAL QUARTERS FOR COMFORT AND PRODUC-

Iowa State Univ., Ames. Dept. of Agricultural Engineering. T. E. Hazen.

Journal of Animal Science, Vol 32, No 3, p 584-589, 1971. 20 ref.

Descriptors: \*Design criteria, Farm wastes, Research needs, Air pollution effects, Farm management, Confinement pens, Investment economics, Temperature control. Identifiers: Animal quarters, Air purity.

Several reasons account for the shortages in livestock housing design. The most frequent reason is either the added construction or operating cost necessary to obtain something better. Very little is known about the chemical and biological environ-ment systems and the quantitative effects they may have on animal comfort and productivity. In this respect, manure management is now under intensive study because fecal and urinary wastes appear to contribute most to the formation of undesirable conditions. Reasonably adequate data are now available on the treatment and disposal of wastes, but acceptable systems are lacking for separating the manure safely and efficiently from the animal and surroundings. (Bundy-Iowa State) VOLATILIZATION OF NITROGEN-CONTAINING COMPOUNDS FROM BEEF CATTLE AREAS,
Nebraska Univ., Lincoln. Agricultural Experiment

L. F. Elliott, G. E. Schuman, and F. G. Viets. Soil Science Society American Proceedings, Vol 35, p 752-755, 1971. 4 fig, 10 ref. CH WA Agu and For W7

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Descriptors: \*Farm waste, \*Ammonia, Fertilizer, Pasture, Crop response, Land use, Dust, Cattle.
Identifiers: \*Acid trap, \*Cattle feedlot, Distillablenitrogen, Temperature-dependent, Aliphatic
amines, Corn stubble.

The release of NH3 plus steam-distillable organic N compounds to the atmosphere from a small beef compounds to the atmosphere from a small beef feedlot and a pasture was measured. Acid traps placed next to the feedlot and 0.8 km from the feedlot averaged 148 and 16 kg/ha per yr NH3 plus steam-distillable organic N compounds, respectively. The same traps averaged 21 and 3.3 kg/ha per yr, respectively, or organic N compounds that were not recovered by the 3 min steam distillation procedure. Feedlot disturbances, such as manure mounding, increased volatilization of N compounds. Ammonia plus steam-distillable organic N compounds trapped near a cattle pasture and cropland averaged 15 and 11 kg/ha per yr, respectively. Organic N compounds not recoverable by the 3-min steam distillation were very low in the areas. Normally, steam distillation values represent only NH3; however, in this case, other N-containing compounds were distilled over and titrated as NH3. (Bundy-lowa State) W72-02834

AN ASSESSMENT OF SOME PUBLIC HEALTH PROBLEMS RESULTING FROM FEEDING POULTRY LITTER TO ANIMALS. MICROBIOLOGICAL PARAMETERS,

Food and Drug Administration, Cincinnati, Ohio. Div. of Microbiology.
For primary bibliographic entry see Field 05E.
W72-02838

ENZYMATIC EVALUATION OF PROCESSES FOR IMPROVING AGRICULTURAL WASTES FOR RUMINANT FEEDS, Agricultural Research Service, Albany, Calif.

Jack Guggolz, R. M. Saunders, G. O. Kohler, and T. J. Klopfenstein.

Journal of Animal Science, Vol 33, No 1, p 167-170, July 1971. 4 fig, 1 tab, 14 ref.

Descriptors: \*Farm waste, \*Enzymes, \*Biochemistry, \*Digestion, \*Biodegradation, \*Ruminants, Descriptors: "Farm waste, "Enzymes, "Biochematry, "Digestion, "Biodegradation, "Ruminants, Cattle, Sheep, Degradation, Refuse, Cellulose, TDN, Alfalfa, Forages, Lignin. Identifiers: "Onozuka SS, "Agricultural residues, Roughage, Hemicellulose, Reed canary grass, Smooth bromegrass, Tall Fescue.

Agricultural residue high in cellulose and hemicellulose are a potentially valuable source of energy to ruminant animals, but low digestibility of the carbohydrates make some type of chemical or physical modification necessary. A procedure has been developed enabling one to correlate 'in vivo' digestion of residues with 'in vitro' dry matter disappearance. The procedure involves digestion of the crop residue or forage with a crude cellulose enzyme followed by protease digestion. 'Onozuka' SS was found to be the most active cellulose and was added at a rate of 750 milligrams per gram of residue, and incubated at 40C for 72 hours. At the end of incubation a series of procedures was fol-lowed to separate and weigh the remaining residue. Onne hundred minus the percent residue was called 'total solubles after enzymes' (TSAE). The correlation coefficient between enzymatic and 'in vivo' results for alfalfa, reed canary grass, smooth bromegrass, and tall fescue were 0.997, 0.876, 0.998, and 0.999 respectively. The procedure appears to predict dry matter digestibility with sufficient precision to be of use to laboratories with no access to donor ruminant animals. (Schmitt-Iowa State) W72-02839

CHEMICAL AND MICROBIAL STUDIES OF WASTES FROM BEEF CATTLE FEEDLOTS, Agricultural Research Service, Lincoln, Nebr. Soil and Water Conservation Research Div. For primary bibliographic entry see Field 05D. W72-02847

ANIMAL AND HUMAN METABOLIC WASTES. Illinois Univ., Urbana. Council on Environmental Quality. For primary bibliographic entry see Field 05E. W72-02848

GENERAL ANALYSIS OF LONGITUDINAL DISPERSION IN NONUNIFORM FLOW, Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering. L. W. Gelhar, and M. A. Collins.

Water Resources Research, Vol 7, No 6, p 1511-1521, December 1971. 4 fig, 1 tab, 20 ref.

Descriptors: \*Dispersion, \*Non-uniform flow, \*Groundwater movement, \*Path of pollutants, Mixing, Porous media, Convection, Diffusion, Saturated flow, Analytical techniques, Mathemati-

An analytical method is proposed by which the effects of flow nonuniformity and variable dispersion coefficients can be evaluated for problems involving longitudinal dispersion in porous media. A boundary layer approximation is used to develop general solutions of the one dimensional convective-dispersion equation for steady flow. Com-parisons of the analytical solution with numerical solutions of the exact equation indicate that the method will yield accurate results in many applica-tions. The effects of nonuniformity are incorporated through two integrals of the velocity field, which can be evaluated from analytical expressions or numerical data. This approach should be particularly useful in field applications involving com-plex flow patterns. Initial estimates of dispersion in a natural setting can be developed by using velocity data from numerical or analog modeling of the flow field or direct field observations. The method is currently being used in a study of groundwater quality on Long Island, New York, wherein data from a Hele-Shaw model are used to evaluate the flow field. (Knapp-USGS) W72-02867

OCEAN SLUDGE DISPOSAL BY BARGES, Tetra Tech, Inc., Pasadena, Calif. R.C.Y. Koh.

Water Resources Research, Vol 7, No 6, p 1647-1651, December 1971. 1 fig, 2 ref.

Descriptors: \*Sludge disposal, \*Oceans, \*Dispersion, \*Path of pollutants, Settling velocity, Sedimentation, Water pollution effects, Density, Mix-

A simple model is constructed to examine the dispersion and settling of wastes such as sewage sludge or dredge spoils discharged from barges into the ocean. Several example cases are analyzed using the model; it is found that the proper choice of disposal depends strongly on the local environmental conditions and the characteristics of the waste. (Knapp-USGS) W72-02873

WASTE HEAT DISPOSAL IN THE GREAT Waterloo Univ. (Ontario). Dept. of Mechanical

1

Engineering.
For primary bibliographic entry see Field 02H.
W72-02882

FALLOUT RADIONUCLIDES AS TRACERS OF

LAKE MIXING, Argonne National Lab., Ill. For primary bibliographic entry see Field 02H. W72-02888

MASS OSCILLATION STUDY OF CAYUGA LAKE, N.Y., State Univ. of New York, Buffalo. Dept. of Biology. For primary bibliographic entry see Field 02H. W72-02890

MICROBIAL LIFE AT 90 C: THE SULFUR BACTERIA OF BOULDER SPRING, Indiana Univ., Bloomington. Dept. of Microbiolo-

T. D. Brock, M. L. Brock, T. L. Bott, and M. R. Edwards. J Bacteriol. 107 (1): 303-314. 1971.

Identifiers: Anti, Bacteria, Boulder, Celsius, Colorado, Degrees, Infect-Drug, Life, Microbial, Spring, Streptomycin, Sulfur.

The physiology of the bacteria living in Boulder Spring, Colorado, USA (Yellowstone National Park) at 90 to 93 C was studied with radioactive isotope techniques under conditions approximating natural ones. Cover slips were immersed in the spring; after a fairly even, dense coating of bacteria had developed, these cover slips were incubated with radioactive isotopes under various conditions and then counted in a gas flow or liquid scintillation counter. Uptake of labeled compounds was virtually completely inhibited by formaldehyde, HCl, and mercuric bichloride, and inhibition was also found with strentomeric and acquire acid. The found with streptomycin and sodium azide. The water of Boulder Spring contains about 3 micro g of sulfide per ml. Uptake of labeled compounds oc-curs only if sulfide or another reduced S compound is present during incubation. The pH optimum for uptake of radioactive compounds by Boulder Spring bacteria is 9.2, a value near that of the natu-ral spring water (8.9). Many experiments with a variety of compounds were performed to determine the temperature optimum for uptake of labeled compounds. The compounds were generally similar, with broad temperature optima between 80 and 90 C, and with significant uptake in boiling (93 C) but not in superheated water (97 C). The results show that the bacteria of Boulder Spring are able to function at the temperature of their environment, although they function better at temperatures somewhat lower. The fine structure of these bacteria has been studied by allowing bacteria in the spring to colonize glass slides or Mylar strips which were immediately fixed, and the bac-teria were then embedded and sectioned. The cell envelope structure of these bacteria is quite different from that of other mesophilic or thermophilic bacteria. There is a very distinct plasma mem-brane, but no morphologically distinct pep-tidoglycan layer was seen outside of the plasma membrane. A rather thick diffuse layer was seen, within which a subunit structure was often distinctly visible, and connections frequently occurred between this outer layer and the plasma membrane. The thick outer layer usually consisted of 2 parts, the outer part of which was sometimes missing. Within the cells, structures resembling ribosomes were seen, and regions lacking electron density which probably contained DNA were also visible.—Copyright 1971, Biological Abstracts, Inc. W72-02925

CHANGES IN COPPER FUNGICIDE DEPOSITS ON TOBACCO LEAVES SPRAYED AT WEEKLY INTERVALS,

Tobacco Research Station, Motueka (New Zea-

land). William F. T. Hartill. Rhodesian J Agric Res. 7 (2): 81-87. Illus. 1969. Identifiers: Control, Copper, Deposits, Disease, Fungicide, Intervals, Leaves, Sprayed, Tobacco-D,

The effects of method of application, type of for-mulation, and rainfall, upon the deposition and

weathering of Cu fungicides, were examined. Lowvolume sprays (8.9 gal/acre) applied with a mistblower placed most fungicide on middle leaves.
Medium-volume (60.0-67.5 gal/acre) applied with
droparms tended to place most of the fungicide on
lower leaves but distribution became more even
after the lowest leaves had been reaped. Lowvolume sprays placed most fungicide on leaf tips
but distribution was more even with mediumvolume sprays. Loss of fungicide between sprays
tended to reflect the deposit pattern with most loss
occurring from the heavier deposits. The amount of
fungicide retained on the leaf between sprays was
in approximate inverse proportion to the particle in approximate inverse proportion to the particle size of the formulated material. Deposits obtained with a dust formulation were relatively light and showed poor retentiveness. Losses of both spray and dust formations were only slightly related to the rainfall pattern.—Copyright 1971, Biological Abstracts, Inc. W72-02927

#### 5C. Effects of Pollution

EVALUATION OF EFFECT OF IMPOUNDMENT ON WATER QUALITY IN CHENEY RESERVOIR,

Colorado State Univ., Fort Collins J. C. Ward, and S. Karaki.

Bureau of Reclamation Research Report No 25, 1971. 69 p, 38 fig, 18 tab, 23 ref, append. Bur. Reclam Contract 14-06-D-6578.

Descriptors: \*Water quality, \*Impounded waters, \*Reservoirs, \*Hydrologic data, \*Kansas, Water chemistry, Chemical analysis, Evaporation, Seepage, Turbidity, Hydrologic budget, Solar radiation, Water temperature, Salt balance, Dissolved oxygen, Algae, Bacteria, Odor, Inflow, Dissolved solids, Data collections. Identifiers: \*Cheney Reservoir (Kansas).

The effect of impoundment on the quality of water in Cheney Reservoir near Wichita, Kans. is presented. The reservoir did not stratify during the period of data collection. The increase in the dissolved solids concentration was directly related to evaporation. On an annual basis, 42% of the total inflow was evaporated from the reservoir. Bypassing the poorest quality waters of the stream serving the reservoir is suggested to reduce the dissolved solids concentration in the reservoir and in the stream below the reservoir. The biological ac-tivity within this reservoir did not seem to affect the water quality materially. Odor appears to have stabilized at a threshold odor number of about 5. The effect of the interaction between the microorganisms and nutrients was characterized in the analysis of phosphates, nitrates, and silica concentrations in the reservoir. The dissolved oxygen percent saturation decreased from 100% at the water surface to 82% at a 25-foot depth. (Woodard-USGS) W72-02274

A COMPARATIVE STUDY OF STANDING A COMPAKATIVE STUDY OF STANDING CROPS AND OF PHOSPHORUS AND NITROGEN CONTENTS OF FOUR MACROPHYTE STREAM COMMUNITIES, Michigan State Univ., East Lansing. Dept. of Fishe-

ries and Wildlife.

M Sc Thesis, Michigan State University, 1971. 45 p, 12 fig, 8 tab, 26 ref, append. OWRR C-2205 (No. 3386) (1).Grant 14-31-0001-3153.

\*Standing crop, \*Streams, \*Phosphorus, \*Nitrogen, \*Water pollution effects, Michigan, Eutrophication, Plants, Channel morphology, Data collections, Chemical analysis, Water chemistry, Water temperature. Identifiers: \*Macrophyte stream communities.

The influence of varying levels of eutrophication upon submerged macrophyte communities was studied in four 100 meter sections in three Michigan streams. Phosphorus content within plant tissue

#### Group 5C-Effects of Pollution

reflected concentrations in the water. The percentage of phosphorus in tissue was high in spring, but did not change significantly during the latter part of the growing season. Nitrogen content in tissues remained at levels required to maintain constant N:P ratios. The size of standing crop was influenced N:P ratios. The size of standing crop was influenced more by stream morphology than by levels of enrichment. However, from May 1 to October 1, percent deviation of organic standing crop increased directly with apparent increased eutrophication: August deviations of 8%, 60%, 130%, and 280% were recorded at the four sites. (Woodard-USGS) W72-02307

EFFECTS OF FORCED AERATION ON A HYPEREUTROPHIC LAKE (EFFEKT PRINU-DITEL'NOY AERATSU GIPEREVTRO FIROVANNOGO OZERA), Moscow Institut

Akademiya Nauk SSSR, Geografii.

Rossolimo, and G. S. Shil'krot. Akademiya Nauk SSSR Izvestiya, Seriya Geograficheskaya, No 4, p 48-58, July-August 1971. 3 fig, 8 ref.

Descriptors: Limnology, \*Lakes, \*Eutrophication, \*Aeration, \*Oxygenation, Stagnant water, Water purification, Water circulation, Thermal stratification, Temperature, Hydrogen sulfide, Nitrification, Nitrogen compounds, Phosphorus, Phosphates, Iron, Ice, Seasonal, Water pollution effects, Pollution abatement. Identifiers: \*USSR, Moscow Oblast, Lake Beloye,

Forced aeration is essentially a disruption throughout the entire depth of a lake wherein all changes to the natural system of limnological processes are interrelated. The effects of forced aeration on Lake Beloye (near Moscow) during a period of complete ice cover were examined to determine the oxygen conditions in the lake. Forced aeration disrupted the thermal stratification of the water, curtailed the formation of a hydrogen sulfide zone, provided for continuous mixing and circulation of the water mass and maintained an area of open water in the ice. No carry-over effects of winter aeration on the summer regime of the lake were observed. On the basis of data in the literature, it may be concluded that there are many features in common between summer and winter aeration. (Josefson-USGS)

THE DISTRIBUTION AND CONTROL OF MACROPHYTE BIOMASS IN LAKE WINGRA, Wisconsin Univ., Madison. Water Resources

For primary bibliographic entry see Field 04A. W72-02350

MEASUREMENT OF POLLUTANT TOXICITY TO FISH-III SUBLETHAL EFFECTS AND SAFE" CONCENTRATIONS,

Guelph Univ. (Ontario). Dept. of Zoology.

J. B. Srague. Water Research, 1971, Vol 5, p 245-266, 139 ref.

Descriptors: \*Water pollution effects, \*Toxicity, \*Fish, Growth rate, Performance, Respiration, Disease resistance, Behavior, Reproduction, Bioas-Says, Laboratory tests, On-site tests, \*Lethal limit, Pollutant identification. Identifiers: Sublethal effects, Ecological survey.

Many authors today stress that study of acute toxicity is not sufficient, that there must be more concern with sublethal effects. Understanding the mode of action of a toxicant is the key to understanding the effects of the pollutant. Approaches such as histopathology, histochemistry, haematology, biochemistry, and physiology may be used individually or in concert to determine the mode and severity of the action of a toxicant. Other factors such as growth, performance, respiration, disease resistance, behavior, reproduction and

development can all be used to measure the effects of toxicants. These are the factors that might be included in a bioassay to arrive at a valid conclusion of the toxic effects in a natural system. Such bioassays conducted in the laboratory should provide us an explanation of the results of field tests. The ultimate bioassay is an ecological survey of a pol-luted habitat. These observations should cover a period of several reproduction cycles. Current levels of "safe" are estimated in the range of 0.01-0.4 of the lethal concentration. The higher levels are the result of studies of natural streams and are are the result of studies of natural streams and are based on neglible mortality, while the lower values result from consideration of chronic, sublethal and cumulative toxicity. There is a continuing need for critical reviews on individual pollutants. (Goessling-Texas) W72-02380

BIOLOGICAL RESPONSE TO TERTIARY TREATED EFFLUENT IN INDIAN CREEK RESERVOIR

Utah State Univ., Logan. Dept. of Environmental

Biology.
D. B. Porcella, P. H. McGauhey, and G. L. Dugan. Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 25, October 3-8, 1971. 31 p, 5 fig, 9 tab, 13 ref.

\*Water dilution, \*Phosphorus, \*Detention reservoirs, Tertiary treatment, Algae, Plants, Trout, Aquatic environment, Eutrophication, Nitrification, Reservoir evapora-tion, Reservoirs, Nutrients, Water reuse. Identifiers: South Tahoe Public Utilities District,

\*Indian Creek Reservoir, Nutrient balance.

Indian Creek Reservoir receives tertiary effluent from the South Tahoe Public Utility District. An on-going study is observing the effects of nutrient removal (mainly phosphorus) and the possibility of impoundments as a process for reclaiming water from sewage. The reservoir is changing from a low diversity and high production to a higher diversity and lower production aquatic ecosystem, a more balanced system less likely to be disturbed. High levels of nitrogen and phosphorus exist, although considerable removal of both nitrogen and phosphorus occurs in the reservoir. A balance accounted for phosphorus, but a deficit was found for nitrogen that was attributed to nitrificationdenitrification. Algal growth was observed that was associated with benthic algae. The diversity of benthic organisms was lower than expected in a mature reservoir, but is apparently increasing. Fish survival during the 1971 season indicates that the reservoir continues to be a suitable environment for planted trout species. Aquatic vascular plants are present in some abundance, particularly in the shallow water areas. Though sufficient phosphorus is available no objectionable algal blooms have occurred. Water quality, both chemically and biologi-cally, differs dramatically from the tertiary effluent. from which it predominantly derives, suggests impoundment as an economical process to reduce nitrogen following phosphorus removal. (Morgan-Texas) W72-02412

UTILIZATION OF ALGAE BY DAPHINIA AS INFLUENCED BY CELL SENESCENCE AND

UV IRRADIATION, Maryland Univ., College park. Dept. of Zoology. For primary bibliographic entry see Field 05G. W72-02417

THE COASTAL BENTHIC FAUNA OF LAKE ST. LOUIS NEAR MONTREAL (QUEBEC): I. SOME GENERAL DATA,

Dep. Sci., Biol., Univ., Montreal, Ont., Can. Etienne Magnin.

Ann Hydrobiol, 1 (2): 179-193, Illus, Maps, 1970. Identifiers: Asellus-Sp, Benthic, Bithynia-Tentaculata, Canada, Coastal, Eutrophication, Fauna, Gammarus-Fasciatus, Hyalella-Azteca, Invertebrates, Lake, Lirceus-Sp, Montreal, Plants, Quebec, St Louis.

Lake Saint-Louis, bounded on the north by Mon-Lake Saint-Louis, bounded on the north by Mon-treal Island, consists of 3 kinds of waters: First, the waters of Saint-Lawrence River, green, clearly al-kaline, well-oxygenated, and rich in Ca and Mg; they compose the most important body of the Lake. Second, the waters of Ottawa River, brown with all measuring. with pH measuring 7, and low content in Ca and Mg. Third, are the Saint-Lawrence waters mixed with Ottawa waters. The mixing presents inter-mediary physico-chemical characteristics. Benthos collections, made with a modified Ekman dredge, a Ponar dredge and a Gerking cage, were analyzed. Molluscs and crustaceans, are quantitatively the most important representatives of the littoral benthic fauna. The most abundant species are Bithynia tentaculata L. (Proso-branch) and Gammarus fasciatus Say (Amphipod). Hyalella azteca Sauss. (Amphipod), Asellus sp. and Lirceus sp. (isopods) were also abundant and frequently collected. Population density is night an average of 7500 organisms/cu m was collected near the littoral ected. Population density is high: an average of and 4500/cu m at 100 m from the coastline. Relatively abundant and various aquatic plants serve as a refuge for numerous invertebrates. This study showed evidence of advanced eutrophication of Lake Saint Louis .-- Copyright 1971, Biological Abstracts, Inc. W72-02438

CONTRIBUTION TO THE QUESTION OF EUTROPHICATION OF LAKE CONSTANCE THROUGH THE ALPINE REACHES OF THE RHINE, (IN GERMAN),
Alt Kantonschemiker, Sankt Gallen (Switzerland).

E. Wieser, and P. Link. Schweiz Z Hydrol. 32 (2): 439-452. Illus. 1970. En-

glish summary. Identifiers: Alpine, Constance, Eutrophication, Germany, Lake, Phosphorus, Reaches, Rhine, Sewage, Switzerland, Treatment

The yearly load of 806 tons of total P for the Alpine reaches of the Rhine, determined in 1961 on behalf of the International Commission for the protection of Lake Constance against pollution, is much too high for the dissolved total P and significantly too low for the sum of the dissolved and undissolved total P. The conclusion drawn from the 1061 study of the Alpine regions of the Rhine are therefore only partially correct. If it can be proven that the amount of P released from the sediments in this lake is smaller or equal to the dissolved P load of the Alpine part of the Rhine, the demand for additional installations for P elimination (tertiary treatment of sewage of simultaneous precipitation) for the mechanical-biological sewage treatment plants in the catchment area of the Lake of Constance is fully justified.--Copyright 1971, Biological Ab-

Central Public Health Engineering Research Inst., Nagpur (India). 06Pollution of Upper Lake and its Effect on Bhopal Water Supply, C. A. Sastry, K. M. Aboo, H. L. Bhatia, and A. V. u ci m te oi ui io pi in bi be to st de co Ti

tic ba re ph str W

DI Ca La Flo No Ide Cr No

Environ Health. 12 (3): 218-238. 1970. Identifiers: Bhopal, India, Lake, Pollution.

A 1 yr survey selecting 10 sampling points on Upper Lake, was carried out to study the pollution in relation to the quality of water supplied the city of Bhopal. Chemical, bacteriological and biological characteristics for judging the intensity of pollution were studied. The lake is polluted more intensely at points which are within a few yards of 5 of the 6 water intake wells. The aquatic biotope was also studied. Analysis of samples from different stages of treatment in the 7 treatment plants showed that the treated water was chemically, bacteriologically and biologically safe. The distribution system in the old city area of Bhopal is antiquated; the quality of water from 36 public taps in zones of the old city showed that contamination is frequent in these zones. In new extensions, there was no contamination in the distribution system. Suggestions for improvement are made.-Copyright 1971, Biological Abstracts, Inc.

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#### WATER QUALITY MANAGEMENT AND PROTECTION-Field 05 Effects of Pollution-Group 5C

THERMAL LOADING IN THE MARINE DIS-

TRICT, New York State Dept. of Environmental Conserva-tion, Albany. Albert C. Jensen.

NY Fish Game J. 17 (2): 65-80. Maps. 1970. Identifiers: Damage, Ecological, Fisheries, Load-ing, Marine, New York, Pollution, Thermal.

Increased development of steam electric stations in New York's Marine District is resulting in con-siderable thermal loading of the marine waters. The Marine District includes part of the lower Hudson River, the New York side of Long Island Sound and the Atlantic Ocean out to the 3-mi. limit. Fossil-and nuclear-fuel plants use the Hudson for coolant water, and more nuclear plants are planned for the river. Three fossil-fuel plants are operating on Long river. Three fossil-fuel plants are operating on Long Island Sound and 2 nuclear-fuel plants are planned. Two fossil-fuel plants are operating on the south shore of Long Island. Potential thermal discharge into the lower Hudson River is 3 billion gallons per day. Potential discharge on New York's side of Long Island Sound is 8.2 billion gallons per day. Temperature increase above ambient is between 20 deg and 30 deg F. The Hudson River and Long Island Sound support important commercial fisheries. Thus, the possibility of ecological damage is a serious consideration.—Copyright 1971, Biological Abstracts, Inc. Abstracts, Inc. W72-02530

EVALUATION OF SODIUM NITRILOTRIACETATE AS BUILDER IN DETERGENT FORMULATION: I. DETERMINATION OF THE SEQUESTRATION POWER OF SODIUM NITRILOTRIACETRATE BY COMPARING WITH SOME INORGANIC BUILDER, (IN ITALIAN), S. Gafa, and B. Lattanzi. Riv Ital Sostanze Grasse. 47 (8): 400-410. Illus. 1970. English summary.

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1970. English summary. Identifiers: Acetate, Builder, Builders, Detergent, Determination, Formulation, Inorganic, Nitrilotri, Phosphorus, Pollution, Power, Reduction, Sequestration, Sodium.

A comparison study is reported, of the sequestra-tion power of organic chelating agent, the trisodi-um salt of nitrilotriacetic acid, with 2 inorganic chelating agents mostly used in solid and liquid for-mulations, i.e., sodium tripolyphosphate and tetrepotassium pyrophosphate, respectively. Two of the most common experimental techniques are used for determining the sequestering power of Ca ions: the turbidimetric titration in presence of Ca precipitants and titration through foam formation in presence of soaps. Results obtained by tur-bidimetric titration appear to be more valid because they follow more closely the trends likely to occur from some theoretical considerations. The strict dependency of the sequestration power, thus determined, on variables such as pH, temperature, component concentration, etc. is demonstrated. The use of an organic builder in detergent formulations, in place of the commonly used phosphatebased inorganic builders might contribute to the reduction of water pollution from detergent phosphorus.--Copyright 1971, Biological Abstracts, Inc. W72-02531

BIOLOGICAL IMPLICATIONS OF NUCLEAR DEBRIS IN AQUATIC ECOSYSTEMS, California Univ., Livermore. Lawrence Radiation

Florence L. Harrison.

Nucl Technol. 11 (3): 444-458. Illus. 1971. Identifiers: Aquatic, Biological, Bivalve, Crustaceans, Debris, Ecosystems, Fish, Molluscs,

Nuclear, Nuclide, Radio.

Properties of nuclear debris that affect its distribution and concentration in water systems and the biological availability of radionuclides to edible aquatic organisms were assessed for debris from nuclear cratering events. From particle size dis-tribution, it was calculated that long-distance transport of debris can occur in dynamic water systems. Leachability of debris was found to vary with the radionuclide and with the composition of the leaching solution, and to depend on particle size and distribution of activity in the particle. Biological availability was studied in aquaria or large pool cal availability was studied in aquaria or large pool systems where radionuclide concentrations were followed in water, suspended material and aquatic organisms. Bivalve molluscs and crustaceans usually had higher radionuclide concentrations than fish. The availability of some radionuclides than fish. The availability of some radionuclides was less than that observed in experiments with pure, commercially obtained radionuclides and may be due to differences in physical and chemical form. Estimates of the whole-body dose to man from consumption of the aquatic organisms indicate that 1311, 140Ba/140La, 110m Ag, and 181W are potential major contributors.—Copyright 1971, Biological Abstracts, Inc. W72-02532

# VIBRIO PARAHAEMOLYTICUS IN MYTILUS GALLOPROVINCIALIS IN ITALY, (IN ITALIAN),

A. Perna. Vet Ital. 21 (7/8): 479-484. 1970. s (English sum-

Identifiers: Enteritis, Gastro, Human, Italy, Mussel, Mytilus-Galloprovincialis, Parahaemolyticus.

The presence in mussels from an Italian breeding area of V. parahaemolyticus biotypes 1 and 2 was recorded for the 1st time. Many cases of acute gas-troenteritis in man, of unknown etiology and resulting from the ingestion of uncooked mussels, may be due to the presence of such bacteria in the mus-sels.—Copyright 1971, Biological Abstracts, Inc. W72-02535

COLIFORMS AND FECAL COLIFORMS IN AN OYSTER-GROWING AREA, Food and Drug Administration, Dauphin Island, Ala., Gulf Coast Technical Service Unit. For primary bibliographic entry see Field 05B. W72-02536

MICROBIAL ECOLOGY,

Martin Alexander.

Wiley, New York, N. Y., 1971, 511p. \$12.95. Identifiers: Algae, Bacteria, Ecology, Fungi, Microbial, Protozoa, Virus.

This book focuses upon the key principles upon which microbial ecology is based. By considering the diverse categories of microorganisms, this book outlines a new approach to the interrelationships between microorganisms and their surroundings considering both phenomena and principles. Relating to all groups of microorganisms (bacteria, fungi, algae, protozoa and virsus), this text is a broad gh, algae, protozoa and visusly, this text is a broad introduction to the subject matter. Oceans, fresh-water, soil, the animal body, plant surfaces and other natural ecosystems are considered with particular emphasis upon basic phenomena. Examples are cited, relating information provided to distinct habitats and specific problem areas. Illustrative material, tables summarizing the major ecological phenomena and principles, figures which aid in the understanding and visualization of the concepts and processes being discussed and complete documentation of relevant concepts and approaches are included in the book. Each chapter has numerous reviews as well as references to original papers. This book should be of interest to those wishing to expand their understanding of aquatic soil, marine, medical or public health microbiology, phytopathology and various facets of ecology.—Copyright 1971, Biological Abstracts, Inc. W72-02548

SALINITY, PH, AND ORGANIC NITROGEN OF WATER IN RELATION TO PRESENCE OF MOSQUITO LARVAE, Agricultural Research Service, Savannah, Ga.

David W. Hagstrum, and Stanley E. Gunstream.

Ann Entomol Soc Amer. 64 (2): 465-467. 1971. Identifiers: Culex-Tarsalis, Culiseta-Inornata, Distribution, Larvae, Mosquito, Nitrogen, Organic, Ph, Relation, Salinity.

Water samples were taken on 111 occasions from 52 permanent and semipermanent sources in southeastern California and analyzed for 10 inorganic ions, pH, and organic N. The 6 species of mosquitos (Diptera: Culicidae) with limited distribution in this results and anaerally conversed in water tribution in this region generally occurred in water with lower mean concentrations of ions than the 2 more widely distributed species, Culex tarsalis Coquillett and Culiseta inornata (Williston). The greater mean concentrations of all ions for water samples from sources where the more widely dis-tributed species were collected compared with mean concentrations of ions for water samples from sources where each of the other 6 species was from sources where each of the other o species was collected would support the hypothesis that suc-cessful (widely distributed) species of mosquitoes must be less selective and more tolerant with respect to mean concentrations of ions in their breeding water. Although the results show that the 2 widely distributed species occur in waters with a broader range of ionic concentrations than do spebroader range or ionic concentrations than do spe-cies with limited distribution, the results do not show that other species would not also occur in waters with an equally broad range of ionic concen-trations if other factors did not limit their distribu-tion. —Copyright 1971, Biological Abstracts, Inc. W72-02549

THE MARSHALL BOG NEAR ITASCA PARK, MINNESOTA,

Montreal Univ. (Quebec). Dept. of Biology. Robert Joyal.

Mich Bot. 10 (2): 78-88. Illus. Maps. 1971. Hall Bol. 10(2), 76-08. Hus., maps. 1-91. (Identifiers: Black, Bog, Carex-Lasiocarpa-M, Carex-Stricta-M, Chamaedapne-Calyculata-D, Itasca, Marshall, Minnesota, Park, Peat, pH, Pine-G, Sphagnum, Spruce-G, Tamarack-G, Tempera-

The Marshall bog is a pond-filled Sphagnum bog with a small pond at the center surrounded by a typical minerotropic vegetation evolving towards ombrotrophic conditions. Carex stricta. ombrotrophic conditions. Carex stricta, Chamaedaphne calyculata, and Carex insiccarpa associations are present. The oldest trees invading this exosystem (tamaracks) are 43 years old. Black spruce and 3 spp. of pine are also present. pH va-ries between 4.6 in the mat and 6.6 in the middle of the pond. Temperature at a 1 m depth in Sphagnum peat ranges from 8 C to 11 C in July depending on the plant association. Peat depth in the center of the consolidated mat is 220 cm. A total of 16 Copyright 1971, Biological Abstracts, Inc.
W72-02571

DIVISION OF SOME DIATOMS IN SEA WATER CONTAINING PETROLEUM PRODUCTS, (IN

RUSSIAN), Institute of Biology of the Southern Seas, Sevastopol (USSR).

O. G. Mironov. Biol Nauk. 13 (7): 69-72. Illus. 1970. Identifiers: Coscinodiscus-Granii, Diatoms, Ditylum-Brightivelii, Petroleum, Products, Sea.

Observations were made of the fate of subsequent generations of Ditylum brightivelii and Coscinodiscus granii whose mother cells occur in sea water containing petroleum products. Pollution of sea water with crude oil and black oil reduces the product of the control of the con the number of generations of these algae. No clear characteristics in the development of the daughter cells in pure water were noted after the parental cells came into contact with petroleum products at a concentration of 0.01 ml/liter.--Copyright 1971, Biological Abstracts, Inc. W72-02577

QUANTITATIVE RELATIONS BETWEEN PHYTO-, BACTERIO-, AND ZOOPLANKTON

#### Group 5C-Effects of Pollution

IN FRESH-WATER ECOSYSTEM MODELS (IN RUSSIAN).

Akademiya Nauk Litovskoi SSR, Vilnius. Inst. of

V. N. Lubyanskene, K. K. Yankyavichyus, G. Y. Yankavichyute, and T. S. Kiselite. Tr Akad Nauk Litov SSR Ser V. 3. 99-114. Illus.

1970. English summary.
1970. English summary.
Identifiers: Bacterio, Competition, Dependence,
Ecosystem, Food, Fresh, Link, Models, Phyto,
Plankton, Quantitative, Relations, Reverse.

Experiments show that there is a well-marked reverse dependence link between zoo- and bacterioplankton where the same relation was less obvious between groups of zoo- and phytoplankton. Parallel changes in the quantities between zoo- and phytoplankton as well as between zoo- and phytoplankton are possible only when there is very intense growth of phytoplankton or bacterioplankton. A competition for food materials was established between phyto- and bacterioplankton. Great concentrations of phytoplankton inhibit the development of bacterio- and zooplankton. The elimination of N or P from the composition of the medium disturbed the development of biocenosis of plankton organisms. Bacterioplankton is the most sensitive to the elimination of P from the composition of a medium. The exclusion of K from the environment mostly affects the normal develop-ment of phytoplankton.--Copyright 1971, Biological Abstracts, Inc. W72-02583

AN ECOLOGICAL STUDY OF AQUATIC HABITATS IN NORTH-WEST OVERIJSSEL, THE NETHERLANDS,

Ceskoslovenska Akademie Ved, Brno. Botanicky Ustay.

Blanka Ulehlova

Acta Bot Neer. 19 (6): 830-858. Illus. 1970. Identifiers: Aquatic, Climate, Ecological, Gasses, Habitasa, Insolation, Macrophytes, Micro, Mud, Netherlands, Northwest, Overijssel, Sapropels, Trophisms, Vegetation, Zones.

During summer 1967 an ecological study of the zonation of different macrophytes was made in the 3 basins of Chielgat, Venematen and Zuideindigerwiede in North-West Overijssel, the Netherlands. Chemical properties of sapropels, microclimatic conditions and composition of mud gases in habitats of different macrophyte zones were studied. The 3 basins show various degrees of trophism and different qualities of humic substances in sapropels. The habitats of different macrophytes in the same basin are also different. Each vegetation zone is characterized by a special temperature course in different water and air layers. The temperature course is dependent on the position and structure of the vegetation and on weather condi-tions. Water temperature is influenced by the duration of insolation, and by the direction and strength of wind. Time-shifts in the warming-up of the lower water layers are also of interest. The relative amounts of CO2, O2, N2 and CH4 were estimated both under and in the plant cover of the vegetation cones under study. While under the plant cover CH4 prevails in the gas mixture, in the plant cover CO2, O2 and N2 are of higher importance. The amount of gas mixture, in the plant cover CO2, O2 and N2 are of higher importance. The amount of CO2 .. CH4 and the amount of N2 reflect the outputs of C and N metabolisms which take place in the basins. The gaseous output of C and N metabolisms in the basins under study are related to the tro-phisms of individual basins.--Copyright 1971, Biological Abstracts, Inc. W72-02584

ECOLOGICAL STUDIES IN THE PLANKTON OF CERTAIN FRESHWATER PONDS OF HYDERABAD-INDIA: I. PHYSICO-CHEMICAL

Osmania Univ., Hyderabad (India), Dept. of Botany.

G. Seenayya Hydrobiologia. 37 (1): 7-31. Illus. 1971. Identifiers: Bacteria, Chlorella-Vulgaris, Com-plexes, Diatoms, Ecological, Fresh, Hyderabad, In-dia, Merismopedia-Minima, Microcystis-Aeru-ginosa, Physicochemical, Plankton, Ponds.

Fluctuations in the pH of water were identical to those of carbonate content, which varied inversely with bicarbonates in all the ponds. Free ammonia influenced the pH appreciably in one pond while larger concentrations of phosphates had a buffering effect. Unusually high pH (9.4) was recorded in one of the ponds during the thick growths of Microcystis aeruginosa and Merismopedia minima, which possibly on withdrawal of CO2 from HCO3. possibly, on withdrawal of CO2 from HCO3, released OH ions in the water. Free ammonia and albuminoid ammonia varied almost directly to each anounmote ammonta varied almost uncerty to each other in 2 ponds but converse was true for the third. Their relative proportions in water possibly depended on the bacterial activity. Appreciable quantities of nitrates were brought into the ponds with surface run-off. The days of high nitrate contents also coincided with those of low values for tents asso coincided with those of now values in free ammonia. The pond which showed a bloom of Chlorella vulgaris, experienced biological destruction of nitrates. The pulses of phytoplankton were accompanied by the accumulation of oxidizable and nitrogenous organic matter in water. This in-dicated that quite large quantities of extracellular substances were liberated into it. Generally speak-ing, the concentrations of Fe increased with the fall in pH of the water. The low concentration of this element was helpful in accelerating the decomposition of organic matter. The pulses of diatoms resulted in a decrease of silica in these water.— Copyright 1971, Biological Abstracts, Inc. W72-02585

COMPARATIVE BACTERIOLOGICAL IN-VESTIGATION OF THREE SHALLOW HUN-GARIAN LAKES WITH DIFFERENT TROPHIC

Magyar Tudomanyos Akademia, Tihany. Biologi-cal Research Inst.

Janos Olah, and Reka Vasarhelyi.

Janos Olan, and Reka Vasarnelyi.
Ann Inst Biol (Tihany) Hung Acad Sci 37: 223234. Illus. 1970. Russian summary.
Identifiers: Bacterio, Bacteriological, Biomass,
Bringman, Coli, Comparative, Hungarian, Lakes,
Plankton, Shallow, Stratification, Test, Trophic.

The quantity of both the saprophytes (5-27 times 10 to the third power/ml), and total bacterioplank-ton (3-8.8 times 10 to the 6th power/ml) in Inner Lake is in accordance with the data in literature referring to eutrophic lakes. However, the extremely low quantity of the bacterioplankton in the extensive and shallow Lake Balaton and Velence Lake does not reflect the true trophic state. The quantity of saprophytes and total bacterioplankton in the areas with reeds in Velence Lake is different and it is in inverse ratio to the Secchi transparency. The COD (chemical oxygen demand) values and Bringman's Coli biomass test have little alteration. Examination of the 8 reeds-open water sections show that the quantity of saprophytes in the reeds is always greater than in the open water. The reeds-open water sections in Lake Balaton have the open water sections in Lake Balaton have the highest amount of saprophytes at the border of reeds-open water. Also, the amount of the total bacterioplankton in the reeds can decrease to a low value (1 times 10 to the 4th power/ml). Vertical surveys show the possibility of the formation of bacterioplankton stratification in shallow lakes like Lake Balaton besides the heterogeneous vertical distribution.—Copyright 1971, Biological Abstracts. Inc. W72-02588

CHAPTER III - A SUMMARY OF THE FINDINGS,

New Mexico Univ., Albuquerque. For primary bibliographic entry see Field 06B. W72-02617

PESTICIDES. THEIR EFFECT ON MAN AND ANIMALS. WATER POLLUTION,

C. Motas

Ocrotirea Natur. 14 (1): 21-33. Illus. 1970.

Identifiers: Animals, Control, Insect, Man, Pesticides. Pollution.

Some of the more characteristic facts were collected from literature published on this problem. It is shown how the use of pesticides under the control of specialists should not be condemned because they can lead to the eradication of certain severe diseases and can check the often considerasevere diseases and can check the often considera-ble damages caused to human economy and to na-ture by insect multiplication. Harmful effects on air and water pollution are discussed.—Copyright 1971, Biological Abstracts, Inc. W72-02639

ON THE ECOLOGY OF THE IDE IDUS (L.) IN THE RIVER KAVLINGEAN, SOUTH SWEDEN, und Univ. (Sweden). Dept. of Animal Ecology. Plutarco Cala.

Rep Inst Freshwater Res Drottningholm. 50. 45-99. Illus, 1970.

Identifiers: Crustaceans, Ecology, Ide, Idus-Idus, Insects, Kavlingean, Pollution, River, Rotifers, Salmo-Trutta, South, Spawning, Stocks, Sweden,

Field studies on ide extended from 1963-67. Literature was also reviewed. Fish deaths from O2 depletion have been noted since 1910 with pollution from a sugar factory and other industries implicated. Fish of 9 families, 25 spp. were collected. Salmon (Salmo salar) were eliminated 100 yr ago samon (Samo Saar) were eminimated 100 yr ago, but recent stockings have been partially successful. PHYSI-CAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF THE RIVER ARE SUMMARIZED BRIEFLY. Ide spawned 29 March to 17 April, when daily water temperatures reached 5C. Spawning was completed in 2-3 days when water temperature rose to 7LC and stayed warm. When water temperatures dropped, spawning season was lengthened. Largest fish spawn first. Eggs adhere to stone, plants, etc., in shallow streams at 0.5-1.5 m. Hatching occur in 5.5 days at 13.8LC and 23 days at 9.3C. Fry were 5.8-6.6 mm long at hatching. Young cease growing in early Nov. at 68-76 mm mean total length. A body-scale relationship as described by 3 straight lines used in calculating lengths at each annulus. Calculated average lengths of 101 male and 132 female ide did not differ significantly. Scales regenerated at 18C but not below 11C. Annulus formation was in May and June with older ide forming annuli earlier than the young. The weight of young ide in-creased as the 3.03 power of the length; that of older ide as the 3.339 power. A spawning season sample of 621 males and 586 females did not deviate significantly from a 1.1 ratio. Stomach contents of 1163 ide indicated that crustaceans and rotifers were the principal foods of ide to 20 mm; insects for ide 10-140 mm, and plant material for ide above 260mm. Large ide spend most of the summer at sea.--Copyright 1971, Biological Abstracts. Inc. W72-02661

SEASONAL VARIATION AND DISTRIBUTION OF 65ZN, 34MN, AND 51CR IN TISSUES OF THE CRAB CANCER MAGISTER DANA, Oregon State Univ., Corvallis. Dept. of Oceanography.

For primary bibliographic entry see Field 05B. W72-02662

THE BIOLOGY AND MANAGEMENT OF EUTROPHIC RESERVOIRS,

Water Treat Exam. 19 (4): 374-399. 1970.

Descriptors: \*Eutrophication. Identifiers: Algae, Biology, Eutrophic, Fauna, Flora, Management, Patterns, Reservoirs.

Some aspects of the biology and management of eutrophic storage reservoirs in the lower Thames Valley are reviewed for the period 1905-1969. The reservoirs range from 6 m to 23 m in depth, and

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution-Group 5C

from 48 ha to 280 ha in area, and are supplied from from 48 ha to 280 ha in area, and are supplied from the River Thames. After retention periods varying from 10 days to many months, the outflows pass to treatment works (rapid sand filtration or microstraining, followed by slow sand filtration and terminal chlorination) supplying about 2/3 of the London water supply. The paper describes the types and quantities of planktonic algae which may affect quality requirements at the treatment works. It is suggested that artificial turbulence techniques, currently under investigation in natural lakes and manade impoundments, should be considered by the made impoundments, should be considered by the waterworks industry as a possible means of modify-ing flora-fauna pattern in eutrophic storage reser-voirs.—Copyright 1971, Biological Abstracts, Inc. W72-02714

SPAWNING AREAS AND ABUNDANCE OF STEELHEAD TROUT AND COHO, SOCKEYE, AND CHUM SALMON IN THE COLUMBIA RIVER BASIN: PAST AND PRESENT, National Marine Fisheries Service, Seattle, Wash.

Diological Lab For primary bibliographic entry see Field 04C. W72-02717

MONITORING ECOLOGICAL CONDITIONS ASSOCIATED WITH WIDE-SCALE APPLICATIONS OF DMA, 2,4-D TO AQUATIC ENVIRONMENTS, Tennessee Valley Authority, Muscle Shoals. Div. of Environmental Research and Development. T. A. Wojtalik, T. F. Hall, and O. Larry Hill. Pestic Monit J. 4 (4): 184-203. Maps. 1971. Identifiers: Aquatic, D, Di, Ecological, Environments, Fish, Invertebrates, Macro, Methylamine, Monitoring, Myriophyllm-Spicatum-D, Phyto, Plankton, Salt, Wide-Scale.

Over 18,000 surface acres of Nickajack and Guntersville Reservoirs were treated with about 170,000 gal. dimethylamine salt of 2,4-D during April-June 1969 to control invading Eurasian watermilfoil (Myriophyllum spicatum L.). The DMA 2,4-D was applied at the rates of 20 and 40 lb of 2,4-D acid equivalent (a.e.) per acre. Representing habitate unware selegated and projected tative habitat types were selected and monitored for 2,4-D content in water, plankton, and sediment and for plankton species composition, distribution, abundance, change, and response.--Copyright 1971, Biological Abstracts, Inc. W72-02720

#### A SURVEY OF THE MUSSELS (UNIONACEA) OF THE ILLINOIS RIVER: A POLLUTED STREAM.

Illinois State Natural History Survey, Urbana.

William C. Starrett. III Natur Hist Surv Bull. 30 (5): 267-393. Illus.

Identifiers: Description, Distribution, Fishery, Il-linois, Mussels, Polluted, River, Species, Stream, Survey, Unionacea.

A survey of the pearly mussel populations of the entire Illinois River was made in order to formulate a sound basis for managing the mussel resource of this river, and to determine what species and dis-tributional changes had taken place during the past century. The species found are described and illustrated. The detrimental effects of pollution and conservation recommendations for the mussel fishery are given.--Copyright 1971, Biological Abstracts, Inc. W72-02722

#### EUTROPHICATION OF SURFACE WATER: LAKE TAHOE.

Utah State Univ., Logan. Dept. of Civil Engineer-

ing.
E. J. Middlebrooks, E. A. Pearson, M. Tunzi, A. Adinarayana, and P. H. McGauhey.
J Water Pollut Contr Fed. 43 (2): 242-251. Illus.

Descriptors: \*Eutrophication.

Identifiers: Blooms, California, Effluents, Lake, Minerals, Selenastrum-Gracile, Surface, Tahoe, USA, Waste, Water.

Although N and P are major factors in the nutrient-rich, or eutrophic condition that leads to algal ns, their presence is not always the critical facbiooms, their presence is not always the critical fac-tor in eutrophication. An effort was made to develop suitable methods of assaying the algal growth-stimulating potential of various influents to lakes and streams and to apply these methods to an evaluation of their ability to increase the eutrophi-cation of water. A test algae, Selenastrum gracile, was used to assess quantitatively biostimulation by exposure to surface runoff exposure to surface runoff, seepages, effluents from various wastewater treatment processes, and Lake Tahoe (California) water. Initial growth response to the test algae was much greater with batch-type assay data than with steady-state condi-tions. Both batch and continuous flow assays in-dicated that the biostimulatory properties of secondragated that the biostimulatory properties of secondary effluents were much greater than that from raw or primary treated wastes. Wastewater effluents of all types showed higher growth response rates than could be accounted for by the amount of N and P present in the samples.—Copyright 1971, Biological Abstracts, Inc.

## LAB. EXP. ON EFFECTS OF H2O TEMP. H2O SALINITY AND LIGHT INTENSITY ON SPAWNING AND SEXUAL DEVELOPMENT OF MATURE OYSTERS (OSTREA EDULIS L.) IN LIMSKI KANAL,

Gillian H. Perusko

Gliniah R. Felusah Identifiers: Condition, Development, Index, Inten-sity, Kanal, Laboratory, Light, Limski, Mature, Os-trea-Edulia, "Oysters, Salinity, Sexual, Spawning, Temperature, Water, Yugoslavia.

Specimens of O. edulis were transported from Lim-ski Kanal and kept in various tanks in the laboratory. Four tanks contained water at various tempera-tures, 4 were at various salinities, and 3 illustrated different light intensities. Results obtained from the periodic examination of the gonads, sick specimens and condition index (CI) showed that there were higher percentages of gonads in advanced stages of development when the oysters were kept at 25C and 20C than at 15C and 8C. Also, 25% salinity was near the lethal limit. The Cl value varies according to the development of the gonads or fatcontains to the development of the globals of target ness. After 20 days exposure to constant light 20% of the oysters spawned.—Copyright 1971, Biologi-cal Abstracts, Inc. W72-02742

### WATER QUALITY OF THE SOVIET UNION - A

REVIEW, Office of the Surgeon General (Army), Washing-

ton, D.C. J. D. LaMothe.

Available from NTIS, Springfield, Va. 22151 Price \$3.00 (paper copy). AD-728 516. Department of the Army, Office of the Surgeon General Publica-tion, July 1971. 103 p, 8 fig, 229 ref.

Descriptors: \*Water quality, \*Water pollution sources, \*Water pollution effects, \*Foreign countries, \*Reviews, Industrial wastes, Municipal wastes, Fishkill, Oily water, Organic wastes, Ecology, Planning, Water quality control. Identifiers: \*USSR.

Information available on the quality of the waters of the Soviet Union is summarized from literature covering the status of the pollution problem, trends in water quality research, legislative events, and long-range environmental restructuring plans that effect water resources. The state of environmental degradation in the Soviet Union is as severe as it is in the United States. Effluent from the Cher-norechensk Chemical Plant near Dzerzhinsk killed almost all of the fish in the Oka River in 1965. The Molognaia River in the Ukraine is officially reported as dead, and many major rivers such as the Volga, Ob, Yenesei, Ural, and Northern Dvina are highly polluted. There are 64,000 population cen-

ters that are earmarked for future development. Out of these, only 7% have centralized water sup-plies. The situation is a great deal worse with regard to centralized sewer systems; provision is made for only 1% of the homesteads. A bibliography of 229 documents is included. (Woodard-USGS)

### POLLUTION PROBLEMS IN FRESH WATER

FISHING IN NORWAY, Einar Snekvik, and Magne Grande. Nor Vet Tidsskr. 82 (4): 180-182. 1970.

Identifiers: \*Detergent, Fish, Fishing, Fresh, Industrial, \*Mercury, Norway, Pesticides, Pollution,

Pollutants affecting Norwegian fresh waters in-clude paper mill and wood-working industrial wastes, containing sulfite and other chemicals, and wood fibers. Mercury from paper mills and pulp mills has led to high Hg concentrations in fish. Pyrite mine wastes, containing acid solutions of Cu and Zn were also found. The softness of Norwegian and 2n were also tould: I no sottless of Nowegian fesh water, 4-15 mg CaO/l, increases the lethal effect of heavy metals on fish. Pesticides, agricultural wastes, and synthetic detergents are also contributors to the pollution.—Copyright 1971, Biological Abstracts, Inc. W72-02787

# A FARIO 'TROUT FURUNCULOSIS' SYN-DROME DUE TO XANTHOMONAS PISCICOLA

L. Joubert, J. Bussieras, S. Ale Agah, and M. Prave. Bull Soc Sci Vet Med Comp Lyon. 72 (2): 199-214. Illus. Maps. 1970.

Identifiers: Aeromonas-Salmonicida, Fario, Furun-culosis, New, Species, Syndrome, \*Trout, Xanthomonas-Piscicola.

A fishing pond, subjected to unfavorable ecological conditions and repopulated by fish probably con-taminated during raising, was infected by a sub-acute form of Fario trout furunculosis. The isolated bacterial strain designated Xanthomonas piscicola (nov. sp.) showed different characteristics from those of Aeromonas salmonicida, classically responsible for salmonid furunculosis. Experimental reproduction of the disease proved the virulence of this organism for the trout. This revealed a hyperreceptivity which was both racial for the Fario trout in relation to the rainbow race and individual-survivors did not remain carriers. Under unfavorable ecological conditions, salmonid furun-culosis, rather than being a disease with a single etiology, appears to be a multiple etiological syndrome involving an organism of low antibiotic sensitivity, which may be responsible for certain treatment failures. Except for antibiotic or sulfonamide treatment, the prophylaxis involves an ecological regeneration of the pond after complete emptying and repopulation with healthy stock. In France the extension and severity of the disease, the principal infection of stock fish and responsible for high losses, have justified regulation concerning official sanitary control of salmon raising in accordance with the International Zoosanitary Code.—Copyright 1971, Biological Abstracts, Inc. W17-02802 sitivity, which may be responsible for certain treat-2-02802

# RESISTANCE OF THE PLAINS KILLIFISH FUNDULUS KANSAE (CYPRINODONTIDAE) TO COMBINED STRESSES OF TEMPERATURE

AND SALINITY,
Oklahoma Univ., Norman. Dept. of Zoology.
Loren G. Hill, and Dale R. Carlson. Proc Okla Acad Sci. 50: 75-78. 1970.

Identifiers: Cyprinodontidae, Fundulus-Kansae, \*Killifish, Plains, Resistance, Salinity, Stresses,

Transference experiments were used to evaluate the resistance of F. kansae to the combined stresses of temperature and salinity. Salinities ranging from 0.5% to 1.5% provided maximum protection against death from heat shock. Higher salinities

#### Group 5C-Effects of Pollution

resumably minimize the survival of the killifish resumably minimize the survival of the killifish when exposed to heat shock. As temperatures decreased optimum salinities for survival decreased. Young-of-year fish manifested greater resistance to test factors than did adults. The habitat preference of a particular life history-form appeared to correlate with its relative resistance to stresses of temperature and salinity.—Copyright 1971, Biological Abstracts, Inc.

W72-02803

TRACE ELEMENTS AND WATER BLOOM (IN

RUSSIAN), Moscow State Univ. (USSR). M. M. Telitchenko, G. V. Tsytsarin, and E. L.

Gidrobiol Zh. 6 (6): 7-12. Illus. 1970. English sum-

Descriptors: \*Trace elements. Identifiers: Aphanizomenon-Flos-Aquae, Bloom, Elements, Microcystis-Aeruginosa, Mineral, Trace,

By emission spectral analysis of material and phytoplankton of the Mozhaisk reservoir the fol-lowing 24 trace elements were determined: Ta, Nb, Au, Hg, W, Sb, Zn, Zr, Ag, Co, Sn, V, Be, Bi, As, Mn, Ti, Ba, Cu, Sr, Mo, Pb, Cr and Ni. Ta, Nb, Au, Hg, W, and Sb were found neither in algae, nor in water. Zn and Zr are accumulated by drying off algae in micro gram/kg of dry weight. The traces (.0000001 g/kg) of Ag, Co, Sn, V, Be, Bi, and As are observed in algae during bloom. The other trace elements were found in both water and algae. Aphanizomenon flos-aquae and Microcystis aeruginosa when blooming in the reservoir, leave traces of Sr, Cr and Ni. The repeated blooms Cyanophyta in the reservoirs are observed only when the water is enriched with Cu of the previous dying algae generation.—Copyright 1971, Biological Abstracts, Inc. W72-02812

THE EFFECT OF LAS VEGAS WASH EF-FLUENT UPON THE WATER QUALITY IN

LAKE MEAD, Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 02H.
W72-02817

THE MISSOURI APPROACH TO ANIMAL WASTE MANAGEMENT,
Missouri Univ., Columbia. Dept. of Agricultural

Engineering. R. M. George, M. R. Peterson, C. G. McNabb, J. W. Robbins, and G. B. Garner.

Missouri Water Pollution Board and Extension Division, University of Missouri - Columbia, MP232/71/1M, p1-65. 21 tab.

Descriptors: \*Farm waste, \*Lagoon, \*Design standards, Aeration, Filtration, Oxidation, Waste disposal, Irrigation, Design, Sprinkler irrigation, Farm management, Swine, Cattle, Anaerobic bacteria, Soil disposal fields.

Identifiers: \*Soil-plant filter, System management,

Livestock producers have asked for guidelines on animal waste management that will be feasible and enduring. With these facts in mind, staff engineers of the Water Pollution Board held a series of meetings with staff members of the Extension Divi-sion and Department of Agricultural Engineering of the University of Missouri-Columbia, to develop guidelines for disposal of waste from confinement feeding operations. The information and design ines are intended primarily for the use of personnel in agencies concerned with animal waste management systems, including detailed information on the components; that is, settling basin and a detention basin. Lagoon systems were outlined giv-ing component parts and sizing with some cost estimates. Guidelines were also given for final waste

disposal, including tankwagons and irrigation from pits and lagoons. The effects of these systems on the surroundings were also discussed. (Bundy-Iowa State) W72-02837

RELATIONSHIPS BETWEEN PRODUCTION, NUTRIENT ACCUMULATION, AND CHLOROPHYLL SYNTHESIS IN AN CHLOROPHYLL SYNTHESIS IN AN ELEOCHARIS QUADRANGULATA POPULA-

TION, Savannah River Ecology Lab., Aiken, S.C. Claude E. Boyd, and David H. Vickers. Can J Bot. 49 (6): 883-888. Illus. 1971.

Identifiers: Accumulation, Chlorophyll, Eleocharis-Quadrangulata-M, En Crop, Emergent, Macrophyte, Nitrogen, Nutrient, Phosphorus, Population, Potassium, Production, Relationships, Standing, Synthesis.

Maximum standing crop in an Eleocharis quadrangulata population was estimated at 881 g dry wt./sq. cm. Net daily productivity was highest dur-ing May when about 50% of the total standing crop was produced. Net productivity for the entire period of vegetative increase, April 1 to Aug. 4, was 7.0 g/sq. cm per day. The accumulation of several nutrients, especially N, P, and K was proportionately more rapid than dry matter produc-tion during early spring growth. Net chlorophyll synthesis was also greater during early spring. Patterns of change in dry matter and chemical sub-stances in the E. quadrangulata population were similar to those in populations of other emergent aquatic macrophytes.--Copyright 1971, Biological Abstracts, Inc. W72-02894

ECOLOGICAL AND FLORISTIC DATA ON THE PLANKTONIC ALGAL FLORA OF A POL-LUTED POND, Louvain Univ. (Belgium). Institut Carnoy.

A. Louis, and C. Beernaert. Biol Jaarb. 37: 61-139. Illus. 1969. Identifiers: Algal, Belgium, Carbon, Conductivity, Di, Ecological, Flora, Floristic, Light, Matter, Minerals, Organic, Oxide, Ph, Planktonic, Polluted, Pond, Temperature.

The polluted lake studied is Blankaart Lake in Diksmide, Belgium. The chemical composition of the water was determined and correlated with the algal species present. The physical characteristics of the water studied were the penetration of light, conductivity, temperature, pH, Fe, NH3, Si, CO2, phosphates, chlorides, organic matter, alkalinity, Ca and Mg contents. Some of the algal groups present were Cyanophyta, Euglenophyta, Chrysophyta, Bacillariophyta, Chlorophyta, Conjugales, and Pyrrophyta.—Copyright 1971, Biological Abstracts, Inc.

A COMPARISON OF PHOTOSYNTHESIS BY PLANKTON IN DIFFERENT LATVIAN LAKES. A. S. Daukshta, and M. B. Vainshtein.

Biol Vnutr Vod Inf Byull. 4. 11-15. 1969. Translated from Ref Zh Biol, 1970, No. 8U115.

lated from Ret Zir Biol, 1770, 1800.
Identifiers: Bacteria, Carbon, Dystrophic, Eutrophic, Flasic, Lakes, Latvian, Light, Method, Oxvoen. Photosynthesis, Plankton, Primary, Oxygen, Photosynthesis, Production, Radio, Season.

In Aug. and Sept. 1967 examinations were made of 9 lakes. The primary production was studied by the oxygen and radiocarbon modifications of the flask method. Determinations were made of the daily dynamics of photosynthesis. In lakes of different types, the daily course of photosynthesis was similar and depended little on the trophicity of the waters, which determine only the absolute values of the primary production. The maximum value of the daily primary production (4.57 mg C/liter) was noted in a eutrophic lake and the minimum (0.04) in dystrophic ones. At the end of the summer, under conditions of light starvation, destruction predominated in lakes of all types. A direct relation is shown between the magnitude of the destruction and the number of bacteria and type of lake... Copyright 1971, Biological Abstracts, Inc. W72-02899

PHYTOTOXIC EFFECTS OF CHERRYBARK OAK, Crown Zellerbach Corp., Camas, Wash.

Dean S. De Bell. Forest Sci. 17 (2): 180-185. Illus. 1971.

Identifiers: Cherrybark, Chromatography, Growth, Liquidambar-Styraciflua-D, Oak-D, Phyto, Quer-cus-Falcata-Var-Pagodaefolia-D, Regulators, Sal-icylic-Acid, Spectrophotometry, Survival, Toxic, Understory.

Growth of natural vegetation as well as survival and growth of planted seedlings of cherrybark oak (Quercus faicata var. pagodaefolia Ell.) were much less beneath large seed trees of cherrybark oak. In greenhouse studies, germination and seedling growth were reduced in soils collected beneath cherrybark oak. Cold-water extracts of fresh, whole leaves of cherrybark oak contained a subwhole leaves of cherrybark oak contained a sweetgum (Liquidambar styraciflua L.) seedlings. Chromato-graphic and spectrophotometric analyses revealed that the primary inhibiting substance in leaf extract was salicylic acid. Leaching of this substance from oak crowns by rain presumably causes inhibition of the understory beneath cherrybark oak.-Copyright 1971, Biological Abstracts, Inc. W72-02911

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THE LIFE HISTORIES AND TROPHIC RELA-TIONSHIPS OF THE TRICHOPTERA OF MARION LAKE, BRITISH COLUMBIA, British Columbia Univ., Vancouver. Inst. of Animal

Resources and Ecology.

Michael J. Winterbourn Can J Zool. 49 (5): 623-635. Illus. 1971. Identifiers: Ambystoma-Gracile, British-Columbia,

Canada, Histories, Lake, Life, Marion, Oncor-hynchus-Nerka, Relationships, Salmo-Gairdneri, Taricha-Granulosa, Trichoptera, Trophic.

Life histories and trophic relationships of Trichoptera were studied in a small British Columbia lal Larvae of 10 caddis species were primarily sedi-ment feeders, 2 were leaf feeders, 3 carnivores, and I Banksiola crotchi, an algal feeder in early instars and predaceous in later ones. The final instar larvae of potentially competitive species tended to be separated in time. Caddis larvae were an important component of the diet of rainbow trout (Salmo gairdneri), species being preyed upon sequentially as their later instars appeared in the lake. Larva were also important as prey of the salamander Taricha granulosa but were less significant in the diets of kokanee salmon (Oncorhynchus nerka) and a 2nd salamander Ambystoma gracile.--Copyright 1971, Biological Abstracts, Inc W72-02919

**HUMAN FLUORIDE INTOXICATION IN PUN-**

Government Medical Coll., Patiala (India), Dept.

of Medicine. S. S. Jolly, S. Prasad, R. Sharma, and B. Rai. Flouride. 4 (2): 64-79. Illus. 1971.

Flouride. 4 (2): 04-79. Inus. 1971. Identifiers: Acroparesthesias, Alkaline, Child, Dental, Fluoride, Fluorosis, Human, India, Intoxi-cation, Myelo, Phosphatase, Punjab, Quadriplegia, Radiculopathy, Secretion, Serum, Skeletal, Spastic, Tyrosine, Urinary.

In an epidemiological survey on fluorosis in India the incidence of dental fluorosis of 46,000 children surveyed was unrelated to that of skeletal fluorosis Periapical tooth resorption and premature loss of teeth is a feature of dental fluorosis in adults. Dental fluorosis occurs where water contains less than 1 ppm F-. Skeletal fluorosis develops after 10 to 30 yr residency in endemic areas with F- levels of drinking water of 1.5 ppm. Of 1300 radiologically

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Waste Treatment Processes—Group 5D

demonstrable cases 309 were asymptomatic, 742 with rheumatic and arthritic complaints, 144 with crippling deformities and 125 with neurological complications. Detailed neurological studies on 73 male and 7 female cases revealed myeloradiculopathy of the cervical and dorsal spine with acroparesthesias, muscular wasting and neuritic pains; spattic quadriplegia was noted in several cases. No evidence of visceral involvement in the endemic area appogared. Mean F- levels were cases. No evidence of visceral involvement in the endemic area appeared. Mean F- levels were recorded as follows: Blood 2.8 ppm; urine 5.3 ppm; bones 3187 ppm (700 - 7000 ppm in dry fat-free bone); teeth 1960 ppm, urinary calculae 22 ppm. In 15 soil samples collected in the endemic areas F-values ranged from 156 to 329 - Company of the collected of the content of the collected of the values ranged from 166 to 389 ppm. Cereals contained .22 to 4.40 ppm F-. Serum Ca, inorganic phosphates, phosphorus clearance and Ca depriva-tion tests showed no significant differences from those of controls. Serum alkaline phosphatase levels were elevated in fluorotic patients. Adrenal functions were normal. Excessive urinary tyrosine excretion was noted.--Copyright 1971, Biological Abstracts, Inc. W72-02939

#### 5D. Waste Treatment Processes

A THERMODYNAMIC ANALYSIS OF A PRIMARY WASTE STABILIZATION POND. Utah State Univ., Logan. Utah Water Research Lah

D. W. Hendricks, W. D. Pote, and J. G. Andrew. Available from the National Technical Information Service as PB-205 282, \$3.00 in paper copy, \$0.95 in microfiche. Report No PRCWRR 16-1, Sep-tember 1970, 63 p, 14 fig, 7 tab, 40 ref. OWRR A-006-Utah (1).

Descriptors: \*Oxidation lagoons, \*Algae, \*Oxidation, Photosynthesis, Oxygen, \*Thermodynamics, Analytical techniques, Design criteria, Kinetics, \*Waste water treatment. Identifiers: \*Solar insolation, \*Stoichiometry.

A 97.5 acre oxidation pond with an average depth of 1 1/2 to 1 2/3 meters, in operation since 1967, was sampled in September 1969 and in June 1970. was sampled in September 1969 and in June 1970. The primary objective was to quantitate the actual energy trade-off, in terms of algae produced vs. amount of waste degraded, for oxidation ponds. Such quantitation was accomplished by: (1) defining the chemical reactions involved-both stoichiometrically and thermodynamically (the latter in terms of equilibrium conditions); (2) meaning the process received the store of t suring terms in a daily mass balance model of an operating primary pond; and (3) evaluating the 'algae production potential' for the pond studied, based upon available solar insolation. These results defined respectively: (1) the calculated absolute lower limit of daily algal synthesis necessary for production of the stoichiometric oxygen to satisfy the daily influent BOD requirement; (2) a measured daily synthesis rate of algae to compare with the daily influent TOC, under conditions of maximum sunshine in the annual cycle; and (3) the cal-culated absolute upper limit of daily algal synthesis, through the annual cycle, if all usable solar energy were utilized. Results established: (1) algae production is significant in proportion to waste degraded, area in the lower limit; (2) actual degraded, even in the lower limit; (2) actual production was over 100 times the stoichiometric amount; and (3) the upper production limit was over 3 times the actual production. All results indicated a vast energy overturn with little or no net effect. (Lowry-Texas) W72-02363

ZINC PRECIPITATION AND RECOVERY FROM VISCOSE RAYON WASTEWATER, American Enka Co., Enka, N. C. Central Engineer-

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National Elina Co., Blaza, N. C. Celluar Engineering Dept.
David M. Rock, and Grady Allman.
Copy available from GPO Sup Doc for \$1.00; microfiche from National Technical Information
Service as PB-EP2.10:, \$0.95, 12090ESG 01/71 PB-205 205. Environmental Protection AgencyWater Quality Office, Water Pollution Control Research Series, January 1971, 86 p, 32 fig, 10 tab. EPA Program 12090 ESG.

scriptors: \*Industrial wastes, \*Heavy metals, \*Chemical precipitation, Hydrogen ion concentra-tion, Neutralization, Sludge, Sedimentation, Cen-rifugation, Textiles, Pilot plant, Operation and maintenance, Cost analysis, \*Waste water treat-Identifiers: \*Zinc. \*Solubilization

A zinc recovery system was developed to recover zinc from dilute zinc sulfate lost both when acid spun yarns are washed and at various stages in the inning process. The process included neutralization of the waste stream to pH 6.0, sedimentation of insolubles, crystallization of zinc hydroxide in a high pH environment, sedimentation of zinc hydroxide and solubilization of the zinc with sulfuric acid. A pilot plant was constructed and operated to provide additional information. At operated to provide additional internation of 600-1000 gpm of influent containing 70-120 mg/l of zn, an effluent zn concentration of less than 1 corresponding to 98-99% mg/l was achieved, corresponding to 98-99% removal efficiency. The zinc hydroxide sludge was easily concentrated to 5 to 7% solids by sedimentaand to 10% solids by centrifugation. Operating and maintenance costs were estimated at 12.5 to 14.0 cents/lb of zn recovered. Recovery and sale of 2000 lbs of zinc daily assures recovery of these costs. (Lowry-Texas) W72-02364

COMBINED TREATMENT OF DOMESTIC AND INDUSTRIAL WASTES BY ACTIVATED

City of Dallas, Oreg.

Copy available from GPO Sup Doc for a \$1.23; microfiche from NTIS as PB-EP2.10;, \$0.95. 12130 EZR 05/71, PB-205 206. Environmental Protection Agency-water Quality Office, Water Pollution Control Research Series, May 1971, 125 p. 30 fig. 7 tab. 20 ref. EPA Program 12130 EZR, Grant No. 11060 EZR.

Descriptors: \*Waste water treatment, \*Municipal \*Industrial wastes, Canneries, Activated sludge, Operation and maintenance, Organic load-

ing, Aeration, Cost analysis, Oregon.
Identifiers: \*Aerobic digestion, \*Process stability,
\*Process flexibility, Shock loads, \*Dallas (Oregon).

A completely aerobic secondary treatment facility was constructed to treat both domestic wastes from the City of Dallas, Oregon, and cannery wastes in season as well. The system was designed for 2.0 mgd average daily flow and a BOD loading of 7000 lbs/day, and its operation was monitored from August 1969 to November 1970. Results indicated that: (1) start-up, operation, and shut-down of the cannery caused no operational problems; (2) the treatment system was sufficiently flexible and sta-ble to withstand shock organic and hydraulic loadings; and (3) a good quality effluent was produced with aeration times varying from 4 to 60 hours. Average effluent BOD and suspended solids concentrations were 8 and 13 mg/l respectively for the test period. Biological solids yield averaged 0.7 lbs solids/lb BOD removed, with a net accumula-tion of .42 lbs solids/lb BOD removed. MLSS concentration ranged from 700 to 3000 mg/l, average sludge age was 19 days, and the organic loading range was from .05 to .40 lbs BOD/lb MLSS/day. Total capital cost was 66% of that for a conventional activated sludge system, and operation and maintenance costs were only 33% of those for a conventional system. (Lowry-Texas)

CONVERSION OF CRANKCASE WASTE OIL INTO USEFUL PRODUCTS, National Oil Recovery Corp., Bayonne, N. J. Solfred Maizus, and Kenneth Urquhart.

Copy available from GPO Sup Doc for \$1.00; microfiche from NTIS as PB-EP2.10:, \$0.95. 15080DBO 03/71, PB-205 207. Environmental Protection Agency-Water Quality Office, Water Pollution Control Research Series, March 1971, 87 p, 4 fig, 3 tab. EPA Program 15080 DBO.

Descriptors: \*Oily wastes, \*Additives, Water quali-ty control, Distillation, Instrumentation, \*Waste water treatment, Water reuse, Oil. Identifiers: \*Waste oil reuse, \*Recycling, Tars.

A simplified technique for reprocessing spent automotive crankcase oils into useful petroleum products other than lube oils, without producing residues which cause water pollution was demonstrated. All of the petroleum products from vacuum distillation of the waste oils were sold as low sulfur heating fuel and as potential diesel fuels. Only the water in the fuel was not recovered. Varying composition of the waste oils accounted for much of the operation difficulty encountered. Use much of the operation difficulty encountered. Use of metal based additives is gaining in popularity, and these additives plus their decomposition products caused numerous clogging problems in the equipment. Feed variability plus increasingly stringent effluent laws resulted in obsolescence of the plant before test runs were finished. Use of the waste oils in the plant was extremely damaging to the equipment, resulting in much greater yearly depreciation than was anticipated. Studies on different products which can use such re-refined petroleum products are continuing. (Lowry-Texas) W72-02366

PHOSPHATE REMOVAL BY ACTIVATED SLUDGE AERATION, Los Angeles City Bureau of Sanitation, Calif. R. B. Bargman, W. F. Garber, and M. Spiegel. Journal, American Society of Civil Engineers, Sanitation, Calif. R. B. Bargman, W. F. Garber, and M. Spiegel. tary Engineering Division, Vol 96, No. SA 1, 1970,

Descriptors: \*Waste water treatment, \*Phosphate, Sludge disposal, Calcium, Aluminum, Iron, Zinc, Hydrogen ion concentration, California, \*Aeration, Activated sludge.

Identifiers: CO2 stripping, Los Angeles, Phosphorus precipitation, Aeration rate.

During a four month period at the Hyperion sewage treatment plant of Los Angeles, California, 29.0 mg/l of phosphate in the primary effluent was reduced to 0.5 mg/l in the secondary effluent; and approximately 150 mg/l of total phosphate was reduced to 0.5 mg/l in the secondary effluent. Preliminary studies indicate that CO2 stripping from increased aeration rates raised the nH from from increased aeration rates raised the pH from 7.0 to 8.6 or more allowing phosphate to precipitate with calcium, aluminum, zinc, iron and other divalent and trivalent ions present in the wastewater. A material balance of the cations present with the phosphate removed and assumed metabolic uptake of phosphorus was close. This high removal is attributed to: (1) increased aeration rates and subsequent CO2 stripping; and (2) no return of waste sludge to the primary tanks. (Morgan-Texas) W72-02369

A RADIOACTIVE LIQUID WASTE TREAT-MENT FACILITY UTILIZING A WIPED-FILM

Ballistic Research Labs., Aberdeen Proving Ground, Md.

Allen Thieme, Ernest W. Bloore, and David L.

Available from the National Technical Information Service as AD-726 901, \$3.00 in paper copy, \$0.95 in microfiche. BRL Report No. 1358, March 1971, 100 p, 23 fig, 14 tab, 16 ref.

Descriptors: \*Radioactive waste disposal, \*Liquid wastes, \*Separation techniques, Evaporation, Distillation, Ion exchange, Resins, Decomposition, Radioisotopes, Pressure, Automatic control, Instrumentation, Piping systems, \*Waste water treatment, Treatment facilities, Waste disposal.

#### **Group 5D—Waste Treatment Processes**

A liquid waste treatment system consisting of a modified Pfaudler Wiped-Film Evaporator, two Permutit ion exchangers, four hold-up tanks, and the necessary pumps, piping, and instrumentation was assembled and operated at a rate of 1 gpm. Influent to the unit was comprised of low-level radioactive wastes, including reactor primary coolant water, liquid decontamination waste generated at reactor sites, and decontamination laboratory, and laundry wastes generated by research laborato ries utilizing radioactive isotopes. Decontamination factors (DF) for the evaporator, feed to distillate, varied from 10 to the 6th power to 10 to the 7th power for cobalt, cescium, and strontium at less than 40,000 ppm solids concentration, while at 40,000 to 160,000 ppm, DF sometime decreased by a factor of 10. Ion exchange following evaporation added a factor of 10. For radium, evaporation DF's were 10 to the 3rd power to 10 to the 5th power for low solids and 10 to the 4th power to 10 to the 6th power for higher solids concentrations, while ion exchange increased the total DF by 10 to 100. Effluent liquid radioactivity was below the 1 x 00000001 micro Ci/ml Maximum Permissible Concentration for direct discharge to the environment. Total cost was \$0.226/gallon using atmospheric evaporation and \$0.143/gallon using vacuum, based on 1750 hours of operation/year at 40 to 50 gal/hr. (Lowry-Texas) W72-02370

MODIFICATIONS TO THE BRIGGS MICRO-ELECTROPHORETIC CELL AND COM-PARISONS WITH THE ZETA-METER CELL, Washington Univ., St. Louis, Mo. Dept. of Environ-

mental and Sanitary Engineering. R. M. Rock, and N. C. Burbank.

Proceedings, Industrial Waste Conference, 20th, May 4, 5, and 6, 1965, p 589-607, 11 fig, 2 tab, 20 ref.

Descriptors: \*Waste water treatment, \*Coagulation, \*Electrophoresis, Colloids, Operations, \*Comparative benefits, \*Comparative costs, Flexibility.

Identifiers: Briggs cell, \*Zeta-Meter cell, Mattson cell, Northrup-Kunitz cell.

A growing interest in applications of micro-electrophoresis (MEP) to the treatment of industrial waters and wastes has led an increasing number of persons to investigate the possibility of installing such apparatus in their laboratories. However, there is a frustrating lack of complete detailed information on design fabrication and operation of the four basic configurations available. A study was undertaken to improve a Briggs cell and then to compare the characteristics of this cell to a Zeta-Meter, another configuration of a MEP cell. The two units were found to be comparable with respect to size, speed of determinations, size of smallest colloid visible, and values of determinations on identical colloid systems. The Zeta-Meter was more rugged, compact and portable. The Briggs cell was cheaper, though certain factors became apparent that could exert an equal in-fluence. The Briggs cell was more suitable for dense colloids and had a wider choice of optics. Determinations of fast settling colloids could be made by vertically oriented Briggs cell, the Zeta-Meter and the horizontally oriented Briggs cell in that order of effectiveness. Highly conductive media favored the use of the horizontal Briggs cell, then the Zeta-Meter and last the vertical Briggs The combined features of the two units together provide a capability for handling an exceptionally wide variety of industrial water and waste coagulation problems. (Goessling-Texas) W72-02371

#### EFFECT OF TEMPERATURE ON OXYGEN TRANSFER IN WATER, Windows Univ (Ontorio)

Windsor Univ. (Ontario). J. K. Bewtra, W. R. Nicholas, and L. B. Polkowski. Water Research, Vol 4, August 19, 1969, p 115-123, 5 fg, 2 tab, 11 ref. Descriptors: \*Aeration, \*Oxygenation, Absorption, \*Dissolved oxygen, \*Temperature, Oxidation lagoons, \*Waste water treatment.

Identifiers: Spiral flow aeration tank, Partial pressure, Regression coefficients, \*Oxygen transfer.

Several investigators have studied the effect of temperature on oxygen transfer but in each of those experiments one or more of the test conditions did not represent common aeration practices. In this study the tests were made in a full-scale aeration tank section with different types of aeration devices arranged similar to arrangements in common practice. Both saran tubes and spargers were used as the diffusion media. The airflow rate ranged between 7 and 32 ft3/min/ft of tank length, and the water temperature range was 10-30 deg C with measurements taken in 2.5 deg C increments. Samples were analyzed by the Winkler method for dissolved oxygen and the rate of oxygen absorption was computed by a mathematical procedure described previously by Morgan and Bewtra (1960). The percent oxygen absorptions at zero dissolved oxygen concentration, obtained for various airflows and temperatures, were plotted for both types of diffusers. Final results of the tests were statistically analyzed and summarized in a mathematical expression. (Morgan-Texas)

#### RECENT PAPER INDUSTRY WASTE TREAT-MENT SYSTEMS,

National Council for Air and Stream Improvement Inc., Gainesville, Fla. Southern Research Center. William I. Gillespie

William J. Gillespie.

Journal of Sanitary Engineering Division, Proceedings of ASCE, Vol 96, No. SA 2, April 1970, p 467-477, 3 fig, 6 ref.

Descriptors: \*Pulp and paper industry, \*Industrial wastes, Oxidation lagoons, Activated sludge, Aeration, Organic loading, Trickling filters, Sedimentation, Biochemical oxygen demand, Sludge disposal, \*Waste water treatment, \*Pulp wastes. Identifiers: Suspended solids.

As of 1966, the pulp and paper industry had expended a total of \$217 million of capital investment in waste treatment facilities. To provide treatment compatible to the Water Quality Act criteria, the capital cost is estimated to be between \$320 million. Primary treatment removal methods are outlined with respect to their application to the pulp and paper industry. Both earthen and concrete sedimentation basins are used. Suspended solids and BOD removals are dependent on the influent, and range from 70 to 100% and 15% to 80% respectively. Stabilization basins are the most widely used secondary treatment facilities. At loading rates of up to 50 lbs BOD per acre, 85% removals are being achieved. Effluents are generally nutrient deficient, so nutrients are added in the ratio of 100 to 5 to 1, BOD to N to P. Trickling filters have also been used as roughing devices, because of their ability to be loaded at rates of up to 200 lbs BOD per 1000 ft. of filter volume. Case histories of both an aerated basin system and an activated sludge system are presented as illustrations. (Lowry-Texas)

### JOINT SEWAGE SCHEME FOR NOTTS AUTHORITIES.

Surveyor, Vol 136, July 24, 1970, p 19-21, 3 fig.

Descriptors: \*Biological treatment, Joint committee on rainfall and runoff, Treatment facilities, Sludge treatment, Sediments, \*Waste water treatment. Identifiers: \*Trent River, \*Sewage system.

After many years of concern over the inadequacy of their sewerage system, disposal plants and particularly the substandard effluent being discharged into the Trent River, a new sewerage and sewage disposal scheme was accepted and built at

Newthorpe, Notts. The compact and highly automated works were designed for construction in three stages to an ultimate capacity of 3.85 million gpd. Treatment works consists of two circular sedimentation tanks with a total capacity of 450,000 gallons, four circular bacteria beds with a total media content of 12,000 cu yd, and two circular humus tanks with a total capacity of 300,000 gallons or six hours retention. The works operate on the recirculation system and it has been possible to combine in a single structure the recirculation pumping station, sludge pumping station, heater house and workshop. The treatment process is designed for a flow of 9 mgd passing through for full treatment. Biological treatment is through eight rectangular ropehauled distributor beds. The final sludge cake can be loaded direct to vehicles, or one day's output can be stored in a bunker. An area of 14.5 sq. miles with a population of 36,000 can be provided for by this scheme with expansion capalitities for handling a population of 66,000. (Biggs-Texas)

#### VALUE OF REAERATION IN AN ACTIVATED-SLUDGE PLANT WHEN DEALING WITH TOXIC DISCHARGE, T Mitchell

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Journal of Water Pollution Control, Vol 69, 1970, p 60-61.

Descriptors: \*Waste water treatment, \*Activated sludge, \*Toxicity, Acids, Hydrogen ion concentration, Turbidity, Biochemical oxygen demand, Onsite tests, Neutralization, Lime, \*Reaeration, Aeration.

The design of the diffused-air activated-sludge plant at the Clyde Park Works of the Burgh of Motherwell and Wishaw included provisions for reaeration of the return sludge. Recently an actidental discharge of acid passes through the plant to the final effluent before discovery. The acid had not penetrated to the reaeration unit, and this unit was isolated from the acid discharge and reaeration continued until the acid in the rest of the works had been neutralized. This took approximately 57 hours and the sludge in the aeration tanks had fallen to 5% of the mixed liquor. One half of the sludge in the reaeration tanks was added to the aeration tanks to restart the treatment process and 24 hours later the second half added. Within a week, the effluent of the works had returned to its former excellent quality. The ability of a wastewater treatment plant to restart itself after a failure such as this adequately demonstrates the utility of reaerating the return sludge. (Goessling-Texas) W72-02377

### WATER SYSTEM FOR AN INTEGRATED STEEL PLANT,

Kaiser Steel Plant, Fontant, Calif.

Journal of the American Water Works Works Association, Vol 61, 1969, p. 432-435, 3 fig

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Steel, \*Water reuse, Cooling tower, Sedimentation, Neutralization, Sludge disposal, Oily water, Ocean, Outlets, Water treatment, Zeolytes, Filtration, Coagulation, California, Treatment facilities.

Maintaining water quality is a subject of current concern by Federal, State and local authorities. The Kaiser Steel Plant at Fontana, California, dates from 1942, when Federal Regulations dictated that large installations be built some fifty miles from the coast to avoid harassment from enemy submarines along the coast. Fontana is a semi-arid location with a limited water supply. Kaiser Steel in its efforts to conserve water removed from the Chino Basin, has in the past been confronted with water pollution problems. The plant was originally forced to recirculate water as a conservation measure and to treat the used water to maintain the quality necessary for succeeding production steps. Now

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Waste Treatment Processes—Group 5D

that the plant has been designed for this procedure, it becomes apparent that we also have created a situation where a water pollution problem can be solved with minimum expenditures. Even with this design goal, some wastes, acid plant sludges par-ticularly, have been difficult to dispose of safely. With the advent of an ocean outfall for the Chino Basin, this problem appears solved. The problems of operating an integrated steel plant with a limited amount of water based on the treatment and reuse of the water are many and continuing. (Goessling-Texas) W72-02378

National Industrial Pollution Control Council, Washington, D. C., Paper Sub-Council.

Availabile from Sup Docs, U.S. Gov't Printing Office, Washington, D.C. 20402, \$0.40 National Industrial Pollution Control Council, Sub-Council Report No. COM 71-50085, March 1971, 58 p, 4

Descriptors: \*Pulp and paper industry, \*Water quality control, \*Air pollution, \*Solid wastes, Odors, Sludge disposal, Color, By-products, Economic feasibility, Organic loading, Legislation, Pulp wastes, \*Waste water treatment, Industrial Identifiers: \*Recycling, Particulates.

The pulp and paper industry was studied to determine what environmental problems are facing the industry, what has been accomplished and what remains to be done by the industry in dealing with these problems, and where and how government can assist. Major problem areas within the industry are: (1) suspended solids in papermill effluents; (2) organic matter content of papermill effluents; (3) particulate emmissions from pulp mill operations and from power plants; (4) gaseous emmissions including odorous sulfur compounds; (5) process solid waste disposal and (6) wastes from forest harvesting. Expenditures by the industry for environ-ment protection totaled \$100 million in 1969, and will approach \$200 million in 1971. A Large proportion of the industrial effluents now receive both primary and secondary treatment either at the plant or in the municipal facility nearest to the plant. Over 60% of the plants have particulate emmission control. Major programs have also been initiated both in reforesting and recycling of fibers in the mills in the amount of 11 million tons in 1969. The industry, with government cooperation and aid, is expected to meet current effluent standards in 5 years or less. (Lowry-Texas) W72-02382

ZONAL CENTRIFUGATION--A TOOL FOR EN-

VIRONMENTAL STUDIES,
Oak Ridge National Lab., Tenn. Applied Physics Div.

For primary bibliographic entry see Field 05A. W72-02384

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TURBULENCE PROMOTERS FOR HYPERFIL-TRATION WITH DYNAMIC MEMBRANES, Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 03A. W72-02385

SCIENTIFIC ADVANCEMENTS MADE TO UP-GRADE AIR AND WATER QUALITY.

Southern Pulp and Paper Manufacture, Vol 33, No.5, May 10, 1970, p 69-70.

Descriptors: \*Waste water treatment, \*Pulp and paper industry, Filters, \*Activated carbon, \*Water reuse, Laboratory tests, Pilot plants, Water conservation, Pulp wastes, Filtration, Industrial wastes, A scientific breakthrough in the pulp and paper in-dustry's drive to drastically reduce water pollution and upgrade environmental quality may be near at hand. Preliminary results of a three year study by St. Regis Paper Company and funded jointly by the Federal Water Pollution Control Agency are very formable. The project is aimed at developing an rederal water Pollution Control Agency are very favorable. The project is aimed at developing an economical method of recycling kraft pulp and paper mill process water by filtering it through activated carbon produced as a byproduct of the radically new process. The next step is the development of a pilot plant to be located at one of the company carries and the contract of the c pany's southern plants. Currently, the fibers and pany's southern plants. Currently, the thoers and other materials in solution with spent chemicals is fired and burned to produce steam and power. Under the new concept, these substances will be converted to a char and activated to form the key raw material under study for water treatment. A critical question to be resolved is the efficiency of activated carbons on specific wastes in mill ef-fluents. The results could indicate the requirement for several different carbons to treat different wastes. This research project is one of the most promising now in progress. (Goessling-Texas) W72-02386

COAGULATION OF ESCHRICHIA COLI BY NEUTRAL SALTS, Ohio State Univ., Columbus. Water Resources

A.J. Rubin, P.L. Hayden, and G. P. Hanna, Jr. Water Research, Vol 3, p 843-852, 1969, 7 fig, 1 tab. 14 ref

Descriptors: \*Coagulation, Suspension colloids, Turbidity, Microorganisms, Hydrogen ion concentration, Cultures, \*Waste water treatment, \*E. Coli, Electrophoresis.

Identifiers: Schulze-Hardy rule, Electrophoretic measurements. Deionization. \*Neutral salts

It has been well established that bacteria exhibit certain colloid characteristics, but the arbitrary selection of 0.1 micro and 1 micro as the boundary limits of colloidally dispersed systems automati-cally excluded bacteria and other microoganisms from this classification. Therefore, an experimental procedure for the systematic study of microbial aggregation was developed and the coagulation of 'Escherichia coli' by neutral salts was investigated. Changes in turbidity as estimated by absorbance measurements during settling were used as the criterion for coagulation. Factors affecting settleability included culture age, solution pH, and the type of concentrations of ions present. It was nonstrated that E. coli 198 (Cincinnati Culture No. 198) are readily coagulated in salt solutions. The critical coagulation concentrations for a series of salts were determined on 12 hour cultures after a 10 hour settling period. The amount o salt required to coagulate the bacterial suspensions varied both with the charge and ionic size of the counterion as predicted by the Schulze-Hardy rule and the lyotropic series of ions. E. coli were found to be coagulated by hydrogen ions and polyvalent ca-tions at concentrations considerably lower than that of simple univalent cations. Apparently, since coagulation by this ion does not follow the Schulze-Hardy rule, it is preferentially absorbed by the organisms. (Biggs-Texas) W72-02387

DISPOSAL OF WASTES FROM WATER TREATMENT PLANTS-PART 3-SECTION 2, REPORT ON CURRENT TECHNOLOGY AND

American Water Works Association Research

Foundation, New York.
D. D. Adrian, and J. H. Nebiker.
Journal of the American Water Works Association,
Vol 61, No 12, December, 1969, 5 tab, 17 fig, 5 ref

Descriptors: \*Waste Water treatment, \*Sludge Descriptors: "waste water treatment, "studge disposal, Water pollution control, Operating costs, "Waste disposal, Capital costs, "Unit costs. Identifiers: Sludge dewatering, Alum sludges, Water softening sludges, Cost analysis models. Section 2 of this 3 section report provides current information on the nature of water treatment plant waste disposal problems current technology and costs. A review of technology provides detailed information on various water treatment waste disposal practices, including descriptions of these processes; data on process efficiency; and, evaluation of process accomplishment A a nanective. processes; usua on process ericitency; and, evaluation of process accomplishments. An appendix reports the analyses of capital, operating, and maintenance charges at many locations throughout the United States. A cost analyses model for dewatering aluminum sulfate sludges and water softening sludges by vacuum filtration, and dewatering of softening sludges by capitality and processes. dges by centrifugation are presented. A discussion of the report by conference participants also is included. (Morgan-Texas) w72-02390

DISPOSAL OF WASTES FROM WATER TREATMENT PLANTS-PART 2-SECTION 1-R-EPORT ON WHAT IS KNOWN, (CONTINUED) STATUS REPORT ON PLANT OPERATION, American Water Works Association Research J. W. Krasanskas, and L. Streicher.

Journal of the American Water Works Association,

Vol 61, No. 11, November 1969, 1 tab

Descriptors: \*Waste Water treatment, \*Sludge disposal, Brine disposal, Administrative agencies, Regulation, Water pollution control, \*Waste disposal, Sludge treatment, Treatment facilities, \*Operations. Identifiers: Alum sludges, Water softening sludges, Filter backwash.

The second part of Section 1 of a 3 section report to provide current information on the nature of water treatment plant waste disposal problems. This part is a status report on plant operations. A discussion is presented on types of water treatment sludge disposal methods and plant waste discharges. These include, alum sludges softening sludges, filter washwater, and brines. Improved techniques to solve waste disposal problems are suggested. A discussion on the status report on plant operation and a discussion on the status report on regulatory aspects is reported, along with the results of questionnaires sent to state regulatory

agencies on various aspects of water treatment

plant waste discharges with emphasis on pollution problems and regulation of discharges. (Morgan-Texas) W72-02391

JOINT DISCUSSION-COMBINED OPERATIONS OF WATER AND WASTEWATER UTILITIES, Richmond. Virginia State Dept of Public Utilities, H. E. Lordley, R. E. Graham, W. A. D. Wurts, and

K. M. Lowthian. Journal of the American Water Works Association, Vol 62, No. 10, October, 1970, p 643-651, 4 tab, 2

Descriptors: \*Waste water treatment, \*Waste treatment, \*Organization, \*Optimization, Cost analysis, Administration, Operations, Legislation, Cities, Municipal wastes.
Identifiers: \*Combined treatment operations.

Representatives of four metropolitan areas presented their views on the advantages and disad-vantages of combining water and wastewater func-tions in the city government. The degrees of com-bination range from separate through combined only at the about to a fully interested combined only at the top level to a fully integrated combined operation. The advantages offered include: (1) consolidated accounting; (2) uniform accounting system for both utilities: (3) strengthening the system for both utilities; (3) strengthening the problem solving staff; (4) centralized responsibility; (5) financial relief through more efficient management, (6) enhanced awareness of total problem of both utilities; (7) more effective manpower utilization, and, (8) better public response due to efficient operation. The disadvantages cited for combining the operations were the magnitude and complexity of the two operations, the different geographical areas served by each, the diversity of

#### Group 5D—Waste Treatment Processes

the functions and the loyalty developed over the years. There are an infinite number of combina-tions of these two functions that can be devised to meet the water and wastewater treatment requirements. Certainly, the allocation of responsibilities for planning, policy making, and administration in these urban water fields should not be considered unalterable. However, there is a great danger in prescribing an approach to combine water and wastewater activities which all urban areas should follow. (Goessling-Texas)

WATER QUALITY STUDY, REPORT 4, WASTEWATER TREATMENT PROCESSES AND CONCEPTUAL PLAN.

Coastal Bend Regional Planning Commission, Corpus Christi, Tex.

Available from NTIS Springfield, Va. 22151 as PB-201 202, \$3.00 in paper copy, \$0.95 in microfiche. 1971. 129 p, 12 fig, 16 tab.

Descriptors: \*River basin development, \*Waste water treatment, \*Sewerage, \*Cost analysis, Long-term planning, Short-term planning, Municipal wastes, Industrial wastes, Farm wastes, Estimated costs, Texas.
Identifiers: \*Texas Gulf coast.

A comprehensive wastewater collection and treatment system for the Coastal Bend area until 1990 was developed. The development consisted of three stages, the first of which was a review of current wastewater treatment methods for primary, secondary, disinfection, and tertiary treatment. The advantages and disadvantages of each process were listed and evaluated to determine their applicability to specific installations. A conceptual plan was then developed to account for all areas in both collection and treatment of the wastes produced. The conceptual plan was developed on a county by county basis, and the results are so presented. Facilities were designed for estimated 1990 wastewater productions, accounting for industrial agricultural, and municipal expansion. A summary was then made of the overall plan including the timetables for each addition and installation. Costs for each county were computed in-dividually. For the 12 county area, total cost was estimated at \$43,761,000. (Lowry-Texas) W72-02393

THE USE OF PILOT PLANT STUDIES IN THE DESIGN OF A MAJOR WASTEWATER TREAT-MENT PLANT.

District of Columbia Dept. of Environmental Services, Washington. Research and Statistics Branch. R. B. Samworth, and J. S. Bethel.

Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 26, No 5, Oct 7, 1971. 14 p, 13 fig, 14 ref.

Descriptors: \*Waste water treatment, \*Primary treatment, \*Teritiary treatment, \*Biological treatment, \*Cost comparison, Nitrogen, Phosphorus, Chemical precipitation, Filtration, \*District of Columbia, Activated carbon, Nitrification, Denitrification, Chlorination.

Identifiers: Air stripping, Breakpoint chlorination, \*Washington, D C.

Pilot plant studies were conducted to provide design and cost data for a waste treatment plant to be located at Washington, D.C., to meet newly adopted water quality objectives for the Potomac River. Three major systems were piloted and alternatives within each system evaluated to seek optimum process configuration comparing both per-formance and cost. The systems were: (1) independent physical-chemical system with two-stage lime precipitation for organic and phosphorus removal, followed by filtration and activated carbon for further organic and phosphorus removal, and ion exchange, air stripping, or breakpoint chlorination for nitrogen removal; (2) conventional tertiary treatment with conventional primary and seconda-

ry biological treatment followed by single or twostage lime precipitation for phosphorus removal, and filtration and ion exchange, air stripping, or breakpoint chlorination for nitrogen removal. Alme precipitation for phosphorus removal, ternatives evaluated differed in method of achieving biological secondary treatment; and (3) biochemical treatment combining primary and secondary treatment with biological nitrificationdentrification for nitrogen removal followed by filtration. Phosphorus removal was by either chemi-cal precipitation with metal salts within the secondary, or separate lime precipitation following denitrification. All systems could meet the effluent objectives, but cost comparisons favored a objectives, our cost comparisons ravored a modified aeration, biological nitrification-denitrifi-cation, and filtration with two-point alum addition for phosphorus removal. (Morgan-Texas) W72-02394

KELOWNA, BRITISH COLUMBIA, TRADE WASTE TREATMENT PLANT, Cornell, Howland, Hays, Merryfield and Hill, Cor-

vallis, Oreg.
Philip G. Hall, and Robert E. Pailthrop.
Preprint, presented at 44th Annual Conference of
Water Pollution Control Federation, Session 6, No 3, October 5, 1971. 9 p, 3 fig, 3 tab.

Descriptors: \*Fruit crops, \*Carbohydrates, \*Industrial wastes, \*Waste water treatment, Eutrophication, Economic feasibility, Operation and Maintennce, Design criteria, Nutrients, Aeration, Oxidation, Centrifugation, Chlorination, Irrigation, \*Treatment facilities. Identifiers: \*Kelowna, B.C. (Canada).

Kelowna, British Columbia, is the center of a large fruit raising and processing area. Okanagan Lake, a valuable tourist attraction, has become increasingly polluted by waste discharge in recent years. Domestic wastes receive both primary and secondary treatment while trade wastes are discharged largely untreated to Brandt's Creek, a tributary of the Lake. Consultants were engaged to determine the safest treatment scheme for the protection of the lake. The two most promising alternatives were expansion of the existing plant and construction of a trade wastes treatment plant. Annual operating and maintenance costs, in this particular instance were 7% less for the separate trade wastes facility. Other reasons indicating the desirability of a separate facility included: (1) more protection for the lake would result from a facility not having a direct discharge to the lake; (2) future waste treatment will include nutrient removal from municipal wastes which was unnecessary for the nutrient poor trade wastes; (3) no program sililar to U.S. Public Law 660 exists in Canada, causing no large capital savings through combination; (4) the process could be tailored directly to the high carbohydrate fruit processing and winery wastes; and (5) the plant would attract other industry since effluents discharged would be handled by the city. (Lowry-W72-02395

DISC-NOZZLE CENTRIFUGES FOR DIF-FICULT SLUDGE THICKENING PROBLEMS, Dorr-Oliver, Inc., Stamford, Conn.

D. R. Vaughn, and G. A. Reitwiesner Preprint, presented at 44th Annual Conference of

the Water Pollution Control Federation, Session 24, No 3, October 7, 1971. 20 p, 8 fig. 3 tab. 5 ref.

Descriptors: \*Waste water treatment, \*Sludge disposal, \*Centrifugation, Cost analysis, Laboratory tests, Pilot plant, Gravity, Settling basins, Dry-

ing. Identifiers: Disc-nozzle design, Recirculation, Full scale operation, Solids recovery

Engineers now recognize the need for a compact and efficient way to concentrate waste sludges. There are few alternatives to the sludge thickening process, gravity, centrifugation and flotation. The Merco disc-nozzle centrifuge has been developed by the Dorr-Oliver Company and has been tested extensively on all types of wastewater and water treatment sludges. The machine operates at 3,000 rpm at feed rates up to 400 gpm. New prototype equipment will soon provide feed rates up to 600 gpm. A built-in recirculation sheme provides: (1) increased overall underflow concentration, (2) flushing action, (3) for the use of larger nozzles, and, (4) for stable operation at the desired operating point. Capital costs for the centrifuge and primary thickener are one third less than a combined gravity thickener. Space for centrifugation is 75% gravity thickener. Space for centrifugation is 75% less than for gravity thickening. Operating costs of \$1.70 per dry ton offset these costs and space advantages. Tests with the sic-nozzle centrifuge indicate that solid concentrations in the range of 4 to 6% TS with satisfactory solids recovery are achievable. Small space requirements, high capacities, rapid processing and continuous operation make this machine a desirable alternative to gravity thickening. (Goessling-Texas)

POLLUTION CONTROL STARTS IN THE COL-LECTION SYSTEM, Black and Veatch, Kansas City, Mo. J. O. Schmidt.

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Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 15, No 3, October 6, 1971. 17 p, 1 fig, 4 tab, 8 ref.

Descriptors: \*Sewers, \*Infiltration, \*Drainage water, Waste water treatment, Maintenance, Monitoring, Specifications, Construction materials, Overflow.

Identifiers: Waste water bypassing, \*Collection systems, \*Television inspection.

The problem of excess extraneous water inflows into sanitary sewers during wet weather periods has existed, but has been tolerated and controlled by by-passing. However, increased wastewater flows together with increased downstream use have caused serious problems and by-passing untreated wastes from sanitary sewer systems is no longer ac-ceptable. Three basic measures which can be taken to reduce the effect of extraneous water entering sanitary sewers are: (1) reduce extraneous water inflow to existing sewers, (2) prevent extraneous water entrance into new sewers, and (3) treat overflows. The first can be accomplished by flow monitoring, repair and replacement using improved methods and materials, and continuous insp particularly of house service connections. New and improved construction material plus strict specifications and TV inspection of new sewer lines can reduce excess flows. Construction of storm water pollution control stations may be necessary to treat overflows that cannot be avoided. (Morgan-Texas)

EFFECTIVE USE OF TV INSPECTION ON SEALING CAN SAVE MONEY,

Halliburton Co., Duncan, Okla. Halliburton Ser-

T. Lenahan, and J. Herndon.

Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 15, No 3, October 6, 1971. 16 p, 9 fig, 2 tab, 8 ref.

Descriptors: Sewers, Maintenance, \*Telemetry, \*Chemical grouting, \*Remote control, Monitoring, Maintenance costs, Water pollution control, \*Inspection, Waste water treatment.

Identifiers: \*Sewer inspection, \*Television inspection, Equipment evaluation.

A closed circuit television system and a companion system for remotely controlled grouting are availa-ble for inspection and maintenance of sewers. A variety of systems can be had from large trailer mounted units down to small mobile units for areas inaccessable to vehicles. These systems are being widely used to obtain information about sewers which previously had been unavailable. The ver satility of the system has proven valuable in several areas. (1) The inspection of new sewer lines prior to acceptance has prevented the inheritance of im-

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

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mediate maintenance problems. (2) The TV system is an excellent tool for finding problems, thus preventing misdirected or wasted efforts. (3) Specific problems, such as infiltration can be located and, in many cases, repairs made using the grouting system without excavation. (4) Television grouting system without excavation. (4) Television provides a means for evaluating maintenance equipment by looking in the line before and after remedial work. (5) The TV system has been used for surveying large sections of lines to update maps and plates. All of these applications have resulted in cost savings and more effective use of maintenance personnel. (Morgan-Texas) W72-02398

PILOT PLANT EVALUATION OF A PHYSICAL--CHEMICAL PROCESS FOR TREATMENT OF RAW AND COMBINED SEWAGE USING POW-DERED ACTIVATED CARBON,
Battelle Northwest, Richland, Wash.
A. J. Shuckrow, G. W. Dawson, and W. F. Bonner.

Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 5, No 4, October 4, 1971. 36 p, 10 fig, 1 tab, 9 ref.

Descriptors: \*Waste water treatment, \*Activated Descriptors: "waste water treatment, "Activated carbon, Storm runoff, Surface runoff, Municipal wastes, "Coagulation, Flocculation, Drainage, Economic analysis, "Pilot plants, Washington, New York, "Sewage treatment, Electrolytes. Identifiers: Combined storm sewers, Regeneration, Polyelectrolytes. Inorganic coagulants. Tube Polyelectrolytes, Inorganic coagulants, Tube settling, Richland (Wash), Albany (NY), \*Combined treatment, \*Polyelectrolytes.

A physical-chemical process for the treatment of raw or combined storm sewage has been developed and is currently undergoing field demonstration in a pilot plant capable of processing 100,000 gallons of sewage per day. The process utilizes powdered activated carbon, inorganic coagulants, and polyelectrolytes to achieve highly efficient solids and organic removal while minimizing detention time and space requirements. Pilot studies have been conducted using raw municipal sewage and combined storm sewage in Richland, Washington and Albany, New York. These operations have indicated good performance, suspended solids removal 95 percent, effluent turbidity 1 TTU, and residual BOD of 10-20 mg/l, with a carbon dose of 600 mg/l, an alum dose of 200 mg/l, and a polyelectrolyte dose of 2 mg/l. A 45 minute overall detention time with a 20 minute contact time prior to flocculation is required for good organic removal. Floc with excellent settling characteristics were consistently produced, and coupled with highly efconsistently produced, and coupled with highly efficient tube settling minimized process detention time. Carbon sludge has been thermally regenerated on a laboratory scale by a fluidized bed process with 90 percent carbon capacity recovery after 3 adsorption/regeneration cycles. 80-100% recovery of alum by acidifying the regenerated cargon-aluminum oxide mixture with sulfuric acid was possible. Process economics indicate capital and constitute systems of the condition of the process of the process of the condition of the process of the

ANAEROBIC LAGOON PRETREATMENT OF PETROCHEMCIAL WASTES, Union Carbide Corp., South Charleston, W. Va.

operating costs for a 10 MGD facility of 1.5 million

and 19 cents/1000 gallons, respectively. (Morgan-

Texas) W72-02400

Onion Carolide Cosp., South Chairson, 17-18. Research and Development Dept.
J. C. Hovious, R. A. Conway, and C. W. Ganze.
Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 22, No 2, October 7, 1971. 32 p, 12 fig, 5 tab, 6 ref.

Descriptors: \*Waste water treatment, \*Chemical wastes, \*Anaerobic conditions, \*Aerobic conditions, \*Mixing, Temperature, Sulfates, Hydrogen sulfide, Lagoons, \*Chemical oxygen demand, Pilot plants, Design specifications, \*Oxidation lagoons. Identifiers: \*Petrochemical wastes, Anaerobic lagoon, Natural mixing, Lagoon depth, Lagoon performance.

The utility of an anaerobic-lagoon step in the treatment of petrochemical wastes was investigated from three aspects: the activity of various microbial groups within the lagoon, overall performance of a pilot and existing lagoons in COD and BOD removal, and removal of specific organic com-pounds. Batch experiments indicate that bottom studge and surface photosynthetic layers both pro-vide approximately 50% COD reduction while the intermediate levels provide approximately 20%. Continuous flow experiments with natural mixing indicated that the influence of relative surface area indicated that the influence of resource surface area (depth) on COD removal was slight, but surface sulfide levels were dependent on depth, being lower at shallower depth. Lagoon temperature also is a function of depth. Influent concentrations of sulfate up to 4000 mg/l were not inhibitory and balances indicated no sulfur loss below 700 mg/l. All identifiable wastes were removed to a signifi-cant degree. Lagoon performance was correlated with volumetric-organic loading and temperature for a number of lagoon installations treating petrochemical wastes and a design procedure for selection of lagoon volume based on loading and erature described. (Morgan-Texas)

A UNIQUE TREATMENT PLANT FOR A UNIQUE PROBLEM, International Paper Co., Ticonderoga, N.Y. W. I. Arnold, and E. L. Barnhart. Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 7, No 4, October 5, 1971. 23 p, 7 fig, 1 tab, 1 ref.

Descriptors: \*Waste water treatment, Pilot plants, Pulp wastes, Temperature, Neutralization, Foam separation, Sludge disposal, New York, Industrial wastes, \*Treatment facilities.

Identifiers: \*Ticonderoga (NY), Lake Champlain, In-plant improvements, Diffuser discharge, Vacuum filters.

To meet water quality requirements for discharge of waste treatment effluent into Lake Champlain the International Paper Mill at Ticonderoga, New York, undertook a study of the effects of plant effluent on the lake, and in-plant improvements to reduce water usage and minimize fiber and chemi-cal losses. Pilot or laboratory studies were conducted to develop design criteria. Conventional primary clarifiers are used and the effluent pH is adjusted prior to secondary treatment. Primary sludge is thickened, then to belt-type vacuum filters, through a 'V' press and incinerated. Secondary treatment, is a surface aerated pond designed to lose heat, eliminating a need for cooling towers, and secondary clarifiers. Effluent is discharged through an 800 ft. diffuser extending 1400 ft. into the lake. A foam trap has prevented any foam from entering the diffuser. In-plant improvements have drastically reduced the amount of colored liquid entering the treatment plant and water quality objectives have been met. The aerated pond was underpowered with respect to mixing, but modification is anticipated that will provide adequate mixing. (Morgan-Texas)
W72-02402

DESIGN FEATURES OF WASTE WATER TREATMENT FOR AN INTEGRATED KRAFT

PULP AND PAPER MILL, Weston (Roy F.) Inc., West Chester, Pa. W. R. Hoover, Jr., R. F. Peoples, and J. A. Hoerner.

Preprint, presented at 44th Annual Conference of the Water Pollution Control Federation, Session 21, No 4, October 7, 1971. 20 p, 3 fig, 5 tab.

Descriptors: \*Waste water treatment, \*Pulp wastes, \*Temperature, \*Neutralization, Water cooling, Aerobic treatment, Foam separation, Ulti-

mate disposal, Texas.
Identifiers: \*Pasadena (Tex), Polymer addition,
Surface aeration, Aerobic digestion.

An integrated Kraft pulp and paper mill at the Passadena, Texas, plant of U.S. Plywood-Champion Papers Inc., was modernized and upgraded to include a new primary and an activated sludge secondary facility. Restricted land necessitated the construction of the new primary adjacent to the old, and on completion, the razing of the old primary to provide stage for secondary feelility. The same for secondary feelility. The same retirements and on completion, the razing of the old primary to provide space for secondary facility. The new primary utilizes circular flocculator-clarifiers with provisions for polymer addition to aid flocculation. Primary sludge is dewated in solid-bowl centrifuges. Provisions for control of an alkaline waste with pH monitoring and two parallel cooling towers for temperature control follow the primary. The secondary facility utilizes two parallel, rectangular, surface aerated aeration tanks followed by two 200 fact dismarks vs. 12 feat SWD exceedings therefore feet diameter x 12 feet SWD secondary clarifiers. feet diameter x 12 feet SWD secondary clarifiers. Thickened sludge is pumped to an aerobic digestion tank. Digested sludge and primary sludge are centrifuged and the dewatered sludge transported to a landfill. Start-up and phasing in of the systems was normal with the major problems foaming in the cooling towers and a high maintenance requirement for the centrifuges. Refinements are continuing. (Morgan-Texas) W72-02403

THERMAL CONDITIONING OF SEWAGE

SLUDGE, Zimpro, Inc., Rothschild, Wis. G. H. Teletzke.

Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 24, No 2, October 7, 1971. 11 p, 7 fig, 4 tab, 15 ref.

Descriptors: \*Waste water treatment, \*Activated sludge, "Sludge treatment, "Sludge disposal, Oxidation, Heat treatment, Dewatering, Chemical sludge treatment, Cost comparison, Nutrients. Identifiers: "Thermal conditioning, Wet oxidation, Odor control. Nutrient recirculation.

Thermal conditioning of sewage sludge to improve dewatering has become an accepted method of sludge treatment because of the desirable characteristics of the dewatered end product produced and the economy of operation achieved when compared to chemical conditioning. Thermal condi-tioning with the addition of air provides some optioning with the addition of air provides some op-portunity for oxidation; and also provides improved heat exchange, odor control, and flexibility. Ther-mal treatment produces a drainable residue by solubilizing and hydroyzing some complex organics which contribute a BOD to the drainage liquor which must be removed. Operating data from Zimwhich must be removed. Operating data from Zim-pro, Inc. thermal sludge conditioning plants in operation indicate that the drainage liquors, although high in BOD and nitrogen content, do not produce a significantly detected effect on the ef-fluent from a conventionally operated activated sludge plant. For one plant the return of thermally studge of the influent BOD, and 15% of the influent total nitrogen on an annual average basis. (Morgan-Texas) W72-02404

THE POLLUTION ABATEMENT PLAN FOR NIAGARA FALLS, NEW YORK, Camp Dresser and McKee Inc., Boston, Mass. R. C. Marini.

Preprint, presented at 44th Annual Conference of the Water Pollution Control Federation, Session 20, No 1, October 7, 1971. 18 p, 9 fig.

Descriptors: \*Waste water treatment, \*Storm drains, \*Municipal wastes, \*Industrial wastes, Water quality, Chemical precipitation, Activated carbon, Cost repayment, Sewers, Waste identification, New York, \*Pollution abatement. Identifiers: \*Niagara Falls (NY), Combined sewers, Separate storm sewers, Collection system, Toxic compounds.

A pollution abatement plan has been formulated for Niagara Falls, New York, which includes con-

### **Group 5D—Waste Treatment Processes**

trol of stormwater and the collection and treatment of municipal and industrial wastewaters to meet the water quality objectives established by the International Joint Commission of the U.S. and Canada, and adopted by New York State. Initially system improvements will limit the amount of mixed storm and wastewater which will overflow from the collection system until a completely separate storm water system can be completed. The design of the collection and wastewater treatment system was based on industry surveys as to type of waste and flows. Significant amounts of toxic compounds that will be present led to the decision to investigate a physical-chemical treatment system. The pilot plant investigated was a combination chemical precipitation of dissolved phosphates, flocculation and sedimentation of suspended matter, and contact with activated carbon for removal of organic matter. Costs were developed and a proposed in-dustrial rate schedule which will amortize the capital investment and cover operational costs. The process is flexible and should meet changing industrial needs. (Morgan-Texas) W72-02405

**FACTORS INFLUENCING BATCH FLOTATION** 

TEST RESULTS, Loma Linda Univ., Calif. Dept. of Environmental

Health Engineering. R. F. Wood, and R. I. Dick.

Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 9, No 3, October 5, 1971. 9 fig, 1 tab, 16 ref.

Descriptors: \*Waste water treatment, \*Sewage sludge, \*Sludge treatment, \*Flotation, Aeration, Laboratory tests.
Identifiers: \*Batch flotation tests, Data scale-up,

Air-solids ratio, Sludge rise rates, Flotation aids.

The procedure which has been used conventionally to conduct batch flotation tests involves the gradual addition of supersaturated water to the entire volume of sludge to be floated. The procedure developed for this work permits continuous blend-ing of proper portions of the sludge and supersaturated water similar to full scale units. Comparison of sludge use rates produced by the two methods demonstrated significant differences, especially with filamentous sludges. The higher rise rates were obtained using the modified procedure developed. Air to solids ratios have been used without mention of aeration pressure as an indication of the amount of 'flotation aid' provided, and the results of this work indicate that errors could be introduced by attempting comparison of batch or continuous flotation results obtained with different aeration pressures. The diameter of batch flotation vessels, the manner in which blended sludge is placed in the vessels, and the initial depth of sludge in the vessels were found to significantly affect batch flotation results with the magnitude of the effect dependent upon the characteristics of the sludge. It is suggested that consideration of these factors which effect batch flotation tests may give data which can be used to more nearly approximate results that can be obtained from a full scale unit. (Morgan-Texas) W72-02406

UTILIZATION AND WASTEWATER TREATMENT OF POTATO PROCESSING PLANTS. THREE

Environmental Control Commission, Prince Edward Island.

O. V. Martini, C. J. Edmonds, and A. J. Hiscock. Preprint, presented at 44th Annual Conference of the Water Pollution Control Federation, Session 3, No 4, October 4, 1971. 23 p, 2 fig, 5 tab, 10 ref.

Descriptors: \*Waste cooling water, Cooling water Descriptors: "waste cooling water, Cooling water recycle, Process equipment, Canada. Identifiers: Separate water treatment, "Water reuse, Water demand, Canneries, Potatoes, Lagooning, Organic loading, Septic tanks, Solid wastes, Cooling water.

Engineering studies were carried out at three rench fry potato processing plants in Province of Prince Edward Island, Canada, to reduce waste-water strength and volume through in-plant changes, with the volume and strength of the wastes requiring treatment to provide design parameters for proposed treatment facilities. A wide variation in water usage between the plants was found; differences in process techniques, but was found; differences in process techniques, but primarily cooling water requirements were responsible for these differences. Proposed in-plant changes included: (1) separation of flume and washwater from other process effluents; (2) separation of cooling water and roof drainage from process water; (3) provide for recycle of cooling water; (4) separate collection of waste solids from process water; (5) separate septic tank effluents from process water to permit process waste solids to be used for cattle feed; and (6) seek improved process equipment to reduce water requirements to be used for cattle feed; and (6) seek improved process equipment to reduce water requirements and waste strength. Treatment facilities proposed include screening and primary treatment with provisions for added secondary and tertiary treatment at a later date for one plant, screening and primary treatment followed by aerated lagoons for the largest plant, and screening with existing hold-ing ponds for the smallest. (Morgan-Texas) W72-02408

A RATIONAL EVALUATION OF INSTRUMENTATION AND CONTROL SYSTEMS,

Maguire (Charles A.) and Associates, Inc., Waltham, Mass. R. H. Babcock.

Preprint, presented at 44th Annual Conference of the Water Pollution Control Federation, Session 2, No 1. 17 p, 3 fig, 2 tab, 8 ref.

Descriptors: Waste water treatment, \*Automation, Instrumentation, Maintenance, Training, Personnel, Cost-benefit analysis, \*Treatment facilitie Identifiers: Intrinsic safety standards, Workshops, Hazardous areas, Contract maintenance.

The dramatic increase in the use of instrumentation in waste treatment plants over the last two decades has produced its share of attendant problems, not the least of which is the inadequate support for, and frequent misuse of, the useful devices in that field of application. Perhaps, the primary contribution to this problem has been the dearth of qualified men for the maintenance of automated systems, and the lack of any coordinated training program in this field to correct the situation. As the trend for the future is for larger and more sophisticated fully automated plants, it is suggested that a practical solution is the use of specialized companies for maintenance on a contract basis. The complex and varied nature of waste processing requires that serious thought be given to the degree and type of in-strumentation. The question of pneumatic versus electronic devices is debatable. Unless the problem of maintenance is properly addressed and resolved, the use of electronics will be seriously hindered. The advent of Intrinsic Safety Standards can simpli-fy and economize on installations in hazardous areas. Since the general level of knowledge con-cerning instrumentation and automation is low, it is suggested that the Water Pollution Control Federation support workshops on this subject. (Goessling-W72-02409

SLUDGE INCINERATION AT JERSEY CITY, NEW JERSEY.

Jersey City Sewerage Authority, N.J.

Robert G. Sobeck.
Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 11, No 1, October 1971. 9 p.

Descriptors: \*Incineration, \*Sludge disposal, Operation and maintenance, Construction costs, Operation and maintenance, Construction cost, Inspections, Personnel, Temperature, Lime, Air pollution, Aggregates, Landfill, \*Waste water treatment, \*Waste disposal, New Jersey. Identifiers: \*Ash, Multiple hearth incineration, \*Jersey City (NJ).

Shortage of land surrounding Jersey City, New Jersey necessitated the construction and operation of an incinerator for the reduction of volume of municipal sewage sludge. Combined sludge flow, including grit and screenings, averaged 60 mgd. All plant personnel who would be involved in the operation of the incinerator were encouraged to visit the construction site as often as possible. In addition, visits were made by key personnel to plant operating incinerators in Bradford, Pa., Detroit, Michigan; and Wyndotte, Michigan. After completion of construction, operation revealed a necessity for reducing lime used, and one of the polymers was substituted as much as possible. Influent sludge was 30% solids dry weight, and of that 30%, 70% was volatile. Upon completion of incineration, 6 1/2% of the influent sludge remained as sterile, inert, sand-like material, some of which is currently ert, sand-like material, some of which is currently being used as aggregate for concrete in patching roads, and the rest used as cover for landfills. Operation and maintenance problems as well as air pollution problems are also discussed. (Lowry-Texas) W72-02410

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NON-BIOLOGICAL APPROACH TO TREAT-MENT OF REFINERY WASTEWATER, Weston (Roy F.) Inc., West Chester, Pa.

R. F. Peoples, P. Krishnan, and R. N. Simansen.
Preprint, presented at 44th Annual Conference of the Water Pollution Control Federation, Session 24, No 4, October 7, 1971. 20 p, 7 fig, 7 tab.

Descriptors: \*Waste water treatment, \*Chemical wastes, \*Filtration, \*Activated carbon, \*Phenols, Pilot plant, Cost analysis, Ultimate disposal, Waste incineration, Industrial wastes, \*Oxygen demand,

Identifiers: Delaware River Basin Commission, Non-biological treatment, Refinery wastewater, Dual-media filtration, Sludge dewatering.

To meet the FSUOD (First Stage Ultimate Oxygen Demand) effluent requirements imposed by the Delaware River Basin Commission the Marcus Hook Refinery, Pennsylvania, of B. P. Oil Corp. initiated an investigation to determine the most suita-ble method to treat process wastewater. Land availability, sludge disposal, and possible future availability, sludge disposal, and possible ruture requirements to improve performance prompted the evaluation of a non-biological system using a filtration system followed by activated carbon. A pilot system using a DeLaval UHR (ultra high rate) filter with dual sand and anthrafilt media showed good removal of oil and suspended solids, moderate removals of BOD5, FSUOD, and Total Carbon (TOC) and low removal of Organic Carbon (TOC), and low removal of phenol. The pilot carbon system used 4 plexiglass columns, the first 3 ft. deep and the remaining 5 ft. deep, with 8 x 30 mesh Filtrasorb 300 activated carbon. The projected throughput indicates an exhaustion rate of 0.86 lbs carbon/1000 gal. with 62% SS, 85% BOD5, 83% FSUOD, 65% TOC and 99% SS, 85% BOIDS, 83% FSUODI, 65% I OC and 999 phenol removals. Sludge is dewatered using a solid bowl centrifuge, and disposed by a privately owned facility or on-site incineration. Expected effluent characteristics are: BOD 50 mg/l, FSUOD 80 mg/l, oil 10 mg/l, SS 20 mg/l, and phenol A 0.2 mg/l. An estimated capital cost breakdown and annual operating costs favor this sytem over a conventional activated sludge system. (Morgan-Texas) W72-02411

COMBINED WASTE WATER RECLAMATION AND SEA WATER DESALTING FACILITIES. Orange County Water District, Santa Anna, Calif.

G. M. Wesner, and R. L. Culp.

Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 21, October 3-8, 1971, San Francisco, California. 28 p,

Descriptors: \*Water reuse, \*Desalination plants, \*Saline water intrusion, \*Groundwater recharge, Settling basin, Sewage effluent, Trickling filter, Water injection, Sludge treatment, California. Identifiers: \*Santa Anna (Calif), Ammonia stripping, Recarbonation.

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Waste Treatment Processes—Group 5D

A pilot study, which was conducted by the Orange County Water District on waste water reclamation and ground water recharge through injection wells, has led to the design of full-scale reclamation and desalting facilities. Treatment in the pilot waste water reclamation plant consisted of: (1) chemical clarification; (2) ammonia stripping; (3) recarbonation; (4) mixed media filtration; (5) carbon adsorption; (6) chlorination. The reclamation plant which will treat the trickling filter effluent was designed for 15 mgd. A 3 mgd sea water desalting plant was also designed because of the agreement OCWD entered into with the Department of the Interior. The desalting plant is a combination vertical tube evaporator/multi-stage flash unit and will produce water with a maximum dissolved solids produce water with a maximum dissolved solids concentration of 25 mg/l. Results from this study and other previous injection studies indicated that the effluent could be treated to produce a water acceptable for injection. While the total dissolved solids concentration of the reclaimed water is higher than desirable for most uses, blending the reclaimed water with desalted sea water, and deep ground water as needed, will furnish injection water with a total dissolved solids concentration of less than 600 mg/l. (Morgan-Texas) W72-02413

COMPOSTING OF DEWATERED SEWAGE SLUDGE,

Eimco Corp., Salt Lake City, Utah. G. L. Shell, and J. L. Boyd. Compost Science, Vol 11, No 3, p 17-21, May-June 1970, 1 tab, 2 fig.

Descriptors: \*Waste water treatment, \*Sludge disposal, \*Biodegradation, Vacuum drying, Temperature, Mositure content, Soil amendments, Dewatering.
Identifiers: \*Compost, Ferric chloride, Lime,

Treatment and final disposal of sewage sludge represents a major cost in the building of treatment plant facilities. A study of composting as an alternative method of sewage sludge disposal has been undertaken. A combination of primary and two-stage trickling filter secondary sludge was used in this investigation. The sludge was dewatered by preliminary treatment with ferric chloride and lime preliminary treatment with terric chloride and lime or with polymers and then vacuum filtered. The resulting filter cake contained 73% moisture. This cake was mixed with recycled compost to obtain compostable mass with 15 to 45% moisture. Op-timum moisture varied between 20 and 35% with average of 26%. Below 15% and above 40% biological action declined as indicated by a reduction in temperature. A laboratory scale digester was used which allowed the mass to be mixed constantly. If mixing was stopped, the temperature dropped in-dicating the cessation of bacterial action. Destruction of volatile solids by biological action caused a reduction in both weight and volume and produced a compost that was stable organically, hygenically safe and free of viable plant seeds. Analysis of the final compost indicated that it was about the 'fertilinter equivalent of cattle manure. The physical and chemical properties of the final compost product were such to make it a safe soil conditioner with some fertilizer value. (Goessling-Texas) W72-02414

#### MARKETING SUCCESS DEPENDS ON SALES ORGANIZATION,

Auckland City Council (New Zealand). G. A. Hutchinson. Compost Science, Vol 11, No 1, January-February, 1970. p 14-16, 3 fig, 1 ref.

Descriptors: \*Solid wastes, \*Incineration, \*Waste

disposal. Identifiers: \*Composting, Sales organization, Land-

Municipal composting can be justified when a local authority has shown that other alternative methods of refuse disposal are more costly, or that close-haul tip sites will be conserved and their useful life

extended. The Auckland municipal compost plant using the two cylinder Dano digester has now been operating successfully for some six years. Its successful financial position, 48% return on operating costs, can be largely attributed to the sound sales organization set up to market the product. The wholesalers in the city that handle this class of product were appointed authorized distributors for the municipal compost. Prices were established. the municipal compost. Prices were established which allowed a reasonable mark-up both for the wholesaler and the retailer. Compost distributed in this fashion can be sold in small (2 cu. ft. or 1/4 cu. this fashion can be sold in small (2 cu. ft. or 1/4 cu. ft. bags) or large lots. Orders can be taken at the plant by the weighmaster and eeliveries made by one of two city owned trucks assigned to this job. The truck bodies are compartmented to allow delivery of any quantity up to 12 cu. yd. The total waste disposal facility includes an incinerator and a sanitary landfill to handle wastes that are not compatible with the composting process. Mixed refuse sanitary another to handle wastes that are not com-patible with the composting process. Mixed refuse is tipped into the digesters without sorting and ma-tured for 2-2 1/2 months after the five day digestion period. Municipal composting can be successful if an objective analysis indicates that it is the best method of waste disposal and the people are informed of the benefits to be realized. (Goessling-W72-02416

DEWATERING OF THE ASH BY-PRODUCT FROM THE WET OXIDATION PROCESS, Metropolitan Sanitary District of Greater Chicago,

W. R. Walters, and G. Ettelt.

Proceedings, Industrial Waste Conference, 20th, May 4, 5, and 6, 1965. p 551-571, 4 tab, 16 fig, 9

Descriptors: \*Waste water treatment, \*Sludge disposal, \*Dewatering, Vacuum drying, Centrifu-gation, Economic analysis, Laboratory tests, Tem-

perature, Illinois, Treatment facilities. Identifiers: \*Zimmerman wet oxidation process, Solid concentration, Vacuum, Polymers, \*Chicago

The Chicago Sanitary District treatment plants must process approximately 900 tons of sludge per day from its primary settling and activated sludge plants. Between 15 and 18% of the sludge is treated plants. Between 15 and 18% of the sludge is treated by the Zimmerman wet air oxidation process. Cur-rently, the effluent from this process is being lagorently, the effluent from this process is being lago-oned, however, future developments may make it desirable to dewater and thicken the oxidized sludge prior to transportation to the ultimate disposal site. Therefore, an investigation of filtra-tion and centrifugation of Zimpro oxidized sludge has been undertaken. Vacuum filtration experi-ments were conducted with variable timperature, vacuum, cycle times and feed solids using drums and belt filters. Coagulant aids did not appear to enhance filtration and in some instances blinded the filter cloth. Cycle times near two minutes were the filter cloth. Cycle times near two minutes were most economic, and results improved with increas-ing temperature. An 18 inch counter current centrifuge was examined as a dewatering device. Anionic polymers assisted operation of the centrifuge, but the process did not appear to be temperature sensitive. Pool depth increases solids recovery up to the point of cake washout. Beyond a certain speed, increasing rotational speed did not increase recovery. Costs scaled up to full plant size increase recovery. Costs scaled up to full plant size were estimated to be \$0.27/ton for preliminary thickening, \$0.30/ton for filtration and \$1.60/ton for centrifugation. This is just a preliminary approach to sludge disposal. The ultimate goal is reuse of these effluents. (Goessling-Texas) W72-02420

ASPECTS CONCERNING THE TREATMENT OF WASTEWATERS FROM OIL REFINERIES IN ROMANIA,

Institute of Hydrotechnical Research, Bucharest

M. G. Negulescu, L. Vaicum, and S. Godeanu. Proceedings, International Conference on Water Pollution Research, 3rd, Munich, Germany, 1966. Vol 2, p 229-246, 5 fig, 3 tab, 14 ref. Descriptors: \*Oil wastes, \*Chemical wastes, \*Industrial wastes, Laboratory tests, Aeration, Coagu-lation, Activated sludge, Emulsions, Acids, Accli-matization, \*Waste water treatment, Oily water. Identifiers: \*Enzymatic activity, \*Romania.

Laboratory scale studies, as well as a review of the pertinent literature, were performed in order to establish the most advantageous methods of treating refinery effluents containing oil from Romanian refineries. The studies were conducted at one of the older installations to which a plate separator had recently been added. Sufficient treatment of the effluent was obtained through a biological treatment scheme with treatment efficiency being disturbed only when large amounts of naphthenic acids were present in the influent to the reactor. Chemical coagulation of the naphthenic acids with aluminum sulfate or ferric chloride was recommended prior to the entrance of the naphthenic acid discharge into the main plant waste stream. In waters without a high concentration of acids, an acid discharge into the main plant waste stream. In waters without a high concentration of acids, an aeration time of 7.5 hours in the activated sludge facility provided optimum economic efficiency. Activated sludge organisms did become acclimated after several months to waters containing large amounts of toxic substances, but both enzymatic activities and treatment efficiency remained depressed. Pilot treatment plants, based on data obtained in the laboratory investigations should provide much additional data. (Lowry-Texas) W72-02422

BIOLOGICAL TREATMENT OF WASTE WATER FROM SYNTHETIC RESIN MANU-FACTURE,

Aero-Research Ltd., Duxford (England). K. G. Singleton.

Proceedings, Purdue Industrial Waste Conference, 21st, May 3, 4, and 5, 1966. p 62-71, 7 tab, 9 ref.

Descriptors: \*Waste water treatment, \*Aeration, \*Activated sludge, \*Trickling filters, Settling basins, \*Oxidation lagoons, Biochemical oxygen demand, Chemical oxygen demand, Sludge digestion, Sludge disposal, On-site tests, Laborato-ry tests, Filtration, \*Biological treatment, Industrial wastes. Tertiary treatment.

CIBA (A.R.L.) Limited of Duxford is the largest producer of synthetic resins in the U.K. The com-pany determined that complete treatment of its astewaters would have to be undertaken to minimize the effect on receiving streams. As the result of numerous experiments and trials, the plant treatment systems now consist of primary aeration, primary treatment (Activated sludge), secondary treatment (two pair of trickling filters that can b connected in series, alternated or connected in parallel) and tertiary treatment (settling pond). The effluents of the settling pond are carried in a channel 0.5 miles long for discharge into the river. channel 0.5 miles long for discharge into the river. The effluent quality surpasses the Royal Commission Standards, 20 mg/l BOD and 30 mg/l suspended solids. Waste water treatment is integrated with the production elements to insure equal consideration with the other plant operations. The wastewater plant manager is able to inspect and investigate manufacturing procedures to restrict or eliminate flows of wastewaters. Wastewater treatment is considered early in new plant design. Pollution abatement is a plant-wide problem that can only be adequately solved by the design. Followion adaptement is a pisant-wood problem that can only be adequately solved by the intelligent functioning of every element of the plant. One outstanding problem, sludge de-watering and disposal, is currently the object of on-going study in the company. (Goessling-Texas) W72-02425

COMPOSTING TREE BARK, WITH SEWAGE. Compost Science, Vol 11, No 2, March-April 1970. p 8-9, 4 fig.

Descriptors: \*Sludge disposal, \*Solid wastes, Ultimate disposal, Industrial wastes, Lumbering, Sewage effluents, Mulching, \*Waste disposal. Identifiers: Composting, Animal bedding, Tree

#### **Group 5D—Waste Treatment Processes**

Creative uses are being made around the world of tree bark, now produced in such vast quantities in forestry and lumbering operations. An excellent opportunity exists to combine the sludges or ef-fluents of wastewater treatment plants with bark as fluents of wastewater treatment plants with bark as the basis of a composting operation which would dispose of two troublesome waste disposal problems and produce a good soil amendment or fertilizer. The nitrogen rich sewage sludge will provide the critical ingredient needed in nitrogen poor compost. Tree bark can also be used as mulch and is popular throughout the country for this purpose. Not so widely adopted is the use of tree bark as stable bedding. The resulting mixture of bark manure ble bedding. The resulting mixture of bark, manure and urine would be an excellent soil conditioner. Almost any use of tree bark would be better than the current parctice of burning. However, the pos-sibility exists that this industrial waste can be used to the benefit of the people. The uses of waste tree bark are limited only by the imagination of the in-dividuals concerned with disposing of this material. (Goessling-Texas) W72-02427

PHOSPHORIC ACID RECOVERY SYSTEM OF THE DETROIT GASKET AND MANUFACTUR-

ING COMPANY,
Detroit Gasket and Manufacturing Co., Belding, Mich. Extended Metals Div.

C. Buckingham.

C. Buckingnam.
Proceedings, Industrial Waste Conference, 22nd,
May 2, 3, and 4, 1967. p 813-822, 6 fig.

Descriptors: \*Waste water treatment, Industrial wastes, \*Acids, Evaporators, Process control, \*Phosphates, Biochemical oxygen demand, Diurnal, Dissolved oxygen, Michigan, \*Water reuse. Identifiers: \*Detroit, \*Phosporic acid, \*By-product recovery.

In an average year, this plant uses approximately 485 tons of 85% phosphoric acid in the chemical brightening of the fabricated aluminum parts produced. Since the phosphoric acid is not a product, the entire amount is either discharged to the Flat River or recovered to the extent necessary to reduce pollution in that river. An acid recovery system suggested by H. R. Tyler was adopted. The system collects the rinse waters containing phosphoric acid, concentrates the solution to approximately 70% phosphoric acid by evaporation and sends the resulting solution to storage tanks to await shipment. Phosphates in the plant effluents have been decreased from 809.5 mg/l to 26.0 mg/l by this process. Based on a year's operation, the recovery rate is caluclated to be 91.57 percent. The value of the acid recovered during the first full year of operation amounts to 40.625 percent of the total or operation amounts to 40.62 percent of the total cost of the phosphoric acid purchased during the same period. The advent of this recovery system has allowed the plant to institute other changes which increased efficiency and reduced costs as well as pollution of the river. Recovery of phosphoric acid from the Company's waste water does not solve the whole problem of waste disposal, but it has solved a major portion of that problem, and is showing both coporate and public benefits. (Goessling-Texas) W72-02429

COST OF INDUSTRIAL AND MUNICIPAL WASTE TREATMENT IN THE MAUMEE RIVER BASIN, Enjay Chemical Co., Baytown, Tex., and Toledo

Univ., Ohio.
J. V. Matson, and G. F. Bennett.
Water-1969, Vol 65, No 97, p 100-105, 1968. 1 fig, 3 tab, 10 ref.

Descriptors: \*Waste water treatment, \*Estimated costs, \*Estimated benefits, Municipal wastes, Industrial wastes, Cost allocation, Cost-benefit analy-

Identifiers: \*Maumee River basin.

The present and future costs and benefits of wastewater treatment in the Maumee River basin were determined for various degrees of treatment. Elements entering the cost calculations were capital costs, amortization, and annual operating cost of waste treatment facilities. Expected beneficiaries were divided into the following five categories: mu-nicipal water supplies, domestic use, industrial use, recreational use, and esthetic enjoyment. Analysis indicated that basin municipalities currently pay 79% of the annual cost of waste treatment, with industry appeared to do a comparable, if not better, job of water pollution abatement. Estimates of future treatment costs varied according to the level of treatment. For instance, compliance with a minimum federally acceptable standard for secondary treatment would cost \$10,000,000 annually, while complete secondary treatment plus activated carbon treatment would cost \$19,000,000 annually. Treatment by evaporation would require \$75,000,000 annually. The economic benefits from cleaner water approach the cost of producing water of that degree of cleanliness at about 93% treatment (that is, removal of 93% of the dissolved organic matter). Annual costs for 93% treatment would approach \$14,300,000, while benefits would be approximately \$13,700,000. (Settle-Wisconsin) W72-02437

INDUSTRIAL WATER REUSE: FUTURE POL-LUTION SOLUTION,

Environmental Protection Agency, Washington, D.C. Office of Research and Monitoring. G. Rey, W. J. Lacy, and A. Cywin.
Environmental Science and Technology, Vol 5, p 760-765, September, 1971.

Descriptors: \*Water reuse, \*Industrial water, \*Pollution abatement, \*Recirculated water, \*Costs, Waste water treatment, Water quality control, Cooling water, Industrial production, Project Identifiers: \*Closed-cycle water reuse, Steam production.

The Water Quality Office of the Environmental Protection Agency has given industrial water reuser recycle projects top priority for research and development support. The ultimate goal of the Of-fice's program is to control and abate industrial pollution through closed cycle water use (no effluent discharge). Multiple use, reuse and/or recy-cle techniques are discussed and illustrated in terms of the three major functions of use--process use, cooling process and steam production. A hypothetical plan to purge limiting waste materials from the reuse-recycle system is also described. The current trend has been toward increased water reuse but still higher ratios are within the realm of engineering possibility. State water quality stan-dards serve to increase industrial pollution control efforts. A typical planning guide for a water reuse research and development program lists the steps farsighted management must take to obtain zero discharge. To calculate potential pollution costs, treatment costs should be viewed as a function of the volume of treated water, amount of undesirable materials to be removed, and amount of intake water purification necessary. The controlling factors and costs of removal for a hypothetical waste water system are shown. (Haugh-Wisconsin) W72-02454

TREATMENT OF WASTES FROM A DYE FAC-

Central Public Health Engineering Research Inst., Nagpur (India). S. S. Mudri, A. L. Kulkarni, P. V. R. Subrahmanyam, and G. J. Mohanrao Environ Health. 12 (3): 201-217. 1970. Identifiers: Activated sludge, Biological, Chemical, Dye, Factory, Oxygen, Sludge, Treatment, Wastes.

The wastes from a factory manufacturing mainly textile printing dyes were characterized. The flow and the chemical characteristics varied greatly. The wastes were intensely bluish green and contained appreciable amounts of dissolved solids and Zn. The COD (chemical oxygen demand) was

nearly 10 times that of the BOD (biological oxygen demand), indicating that the waste contained or-ganics which were not easily bio-degradable. Laboratory studies carried out to arrive at suitable treatment methods indicated that Zn can be treatment methods indicated that Zn can be removed by pH adjustment to 9.2, and color can be treated by chlorination. The waste could also be treated biologically by the activated sludge process after removal of Zn and by diluting 4 times with sewage or water.—Copyright 1971, Biological Abstracts, Inc. W72-02519

PILOT PLANT STUDIES ON THE HIGH RATE

SLUDGE DIGESTER AT HYDERABAD, Central Public Health Engineering Research Inst., Hyderabad (India). Hyderabad Zonal Centre. G. K. Seth, Shanthi L. Kumar, K. Srinivasan, and D.

Environ Health. 12 (4): 340-354. Illus. 1970. Identifiers: Digester, Gas, High, Hyderabad, India, Pilot, Plant, Rate, Sludge.

Studies show that the sludge obtained from the primary sedimentation tanks can well be digested in a high rate zone and the gas recovered could be used as a fuel. Optimum design criteria were worked out.—Copyright 1971, Biological Abstracts, Inc. W72-02521

TOTAL WASTE MANAGEMENT: SYSTEMS, COSTS, EFFICIENCIES, OPTIONS.
State of Illinois, Lake Michigan and Adjoining

Land Study Commission.

In: Report to the Governor and the 77th General Assembly, Vol II - Supporting Studies, October 1971, p 125-162. 1 tab, 11 fig, 53 ref.

Descriptors: \*Wastewater treatment, \*Sewage treatment, \*Planning, \*Sewage sludge, \*Waste disposal, \*Sludge disposal, Wastewater disposal, Costs, Efficiencies, Evaluation, Formulation, Pollutants, Sludge, Systems analysis, Sludge treatment.
Identifiers: \*Solids disposal, \*Wastewater management, \*Total waste management.

There are two basic features of wastewater management. Pollutants, however they may be defined, must be removed from the raw effluent by some process; and the solids or residual pollutants must be disposed of in some safe fashion after they have been removed from the effluent. These two components of wastewater management must be components of wastewater management must be considered together within some systematic framework if a feasible solution to the wastewater treatment problem is to be realized. The study describes various advanced process of wastewater treatment and solids disposal used in wastewater management. The applicability, effectiveness, costs, and the ability of each system to provide total wastewater management are discussed. A systematic framework is proposed and applied to several matic framework is proposed and applied to several examples to demonstrate the interrelatedness of the two basic features, wastewater treatment and solids disposal, and how they can be articulated into a total system. (Davis-Chicago) W72-02599

APPENDIX E - ESTIMATION OF WASTE LOADS AND TREATMENT COSTS, New Mexico Univ., Albuquerque. For primary bibliographic entry see Field 06B. W72-02602

APPENDIX D - TREATMENT, DILUTION, AND TREATMENT COSTS OF MUNICIPAL AND IN-DUSTRIAL WASTES,

For primary bibliographic entry see Field 06B. W72-02603

CHAPTER XII - VARIATIONS IN SELECTED PARAMETERS, New Mexico Univ., Albuquerque.

For prin W72-02

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### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Waste Treatment Processes—Group 5D

For primary bibliographic entry see Field 06A.

CHAPTER XI - SHORT-TERM TERTIARY TREATMENT AND REDUCED STORAGE, New Mexico Univ., Albuquerque.

N. Wollman, and G. W. Bonem.

In: The Outlook for Water, The Johns Hopkins Press, Baltimore, 1971, p 121-130. 5 tab, 9 ref.

Descriptors: \*Tertiary treatment, \*Storage, \*Water resources, \*Planning, Flow, Costs, Biochemical oxygen demand, Decision making, Identifiers: \*Short-term, \*Reduced storage, \*Policy-making, Chemical treatment, Savings, Alterna-

There are three steps in the authors' analysis of the effect of short-term chemical treatment on water resource policy. (1) For a specified flow, construct storage to provide flow 90 percent of the time. Ascertain the difference in capacity and in dollar savings between storage to provide flow 90 percent of the time and storage to provide the same flow 98 percent of the time. (2) Compare savings in storage costs with additional short-term treatment costs. (3) Storage yielding a specified flow 90 percent of the time will yield a smaller flow 98 percent of the time. Ascertain this flow and compare it with required flow after reduction in BOD by short-term tertiary treatment. Of the tables, one indicates that the higher the level of projected activity, the greater the expected savings from short-term chemical treatment will be; another summarizes the effects on storage and costs of the various alternatives; and another shows estimated savings in the costs of storage and estimated costs of continuous chemical treatment for 2000 Medium. (Strachan-

### IMPROVEMENT OF THE DESALINATED WATER'S QUALITY INTENDED FOR DRINK-

F V Shtannikov

Gig Sanit. 35 (12): 10-13. 1970. English summary.

Descriptors: \*Desalination. Identifiers: Drinking water, Purposes.

On the basis of experimental and field investigations the changes which occur in the composition and properties of water desalinated by different means, and the extent of improvement of its quality as a result of treatment by the adsorption method were determined .-- Copyright 1971, Biological Abstracts. Inc. W72-02628

## RESEARCH ON VIRUS IN SEWAGE WATER IN TANANARIVE WITH THE USE OF SOLUBLE FILTERING MEMBRANES,

Service de Sante Des Armees, Tananarive (Madagascar).

Pierre Coulanges, Andre Mayoux, and Edward R.

Arch Inst Pasteur Madagascar. 39 (1): 107-118. 1970.

Identifiers: Coxsackievirus, Enterovirus, Filtering, Human, Madagascar, \*Membranes, Poliovirus, Reovirus, Sewage, Soluble, Tananarive, Virus.

Alginate filtering membranes, soluble in a solution of sodium citrate (0.1 N) were used; 43% of the samples were positive and 34 viruses were isolated for 67 samplings distributed over 1 yr (poliovirus 1 and 3, Coxsackie B, undetermined enterovirus and reovirus). The isolations were more numerous during summer. Some disagreement was shown between the presence or absence of certain viruses in the water and the presence or absence in humans of diseases corresponding to these viruses.—Copyright 1971, Biological Abstracts, Inc. W72-02629 TREATMENT OF DUCK WASTES AND THEIR EFFECT ON THE WATER QUALITY IN THE RAPPAHANNOCK RIVER URBANNA, VIR-

GINIA,
Virginia State Water Control Board, Richmond. R. V. Davis, C. E. Cooley, and A. W. Hadder. Proceedings of the Purdue Industrial Waste Conference 20. May 4, 5, and 6, 1965, p. 626-646, 10

Descriptors: \*Waste water treatment, \*Agricultural wastes, \*Water quality, Oyster, Laboratory tests, On-site tests, Settling basins, Farm wastes.

Barnhardt Farms, Incorporated, Urbanna, Virginia, operates two duck farms that in the past have discharged untreated waste waters from these farms into the Rappahannock River. In the fall of 1962, the Water Control Board was faced with a choice of requiring the owners to treat their wastes or allowing the affected oyster beds to remain closed due to a high coliform count in the water. Several years of study led to the requirement for the farm owners to build holding ponds to retain the wastewater for a period of at least four days prior to discharge. This treatment resulted in a reduction in the MPN coliform count of 95% and allowed the opening of 400 acres of oyster beds to harvesting and water quality improved to the point that recreational use was unimpaired. Further study indicated that an additional 8 day holding period would reduce the coliform count by an additional 4.5% (total 99.5%) to produce an effluent with an MPN of 23 000/100 ml. Recommendations for areas to be included in future studies are included. (Goessling-Texas)

## INCINEROLOGY IN THE PITTSBURGH, PENNSYLVANIA STORY, Allegheny County Sanitary Authority, Pittsburgh,

George A. Brinsko.

Preprint of a paper presented at Water Pollution Control Federation Conference, 44th, Session 11, No. 3, October 5, 1971, 14 p, 3 fig, 4 tab, 5 ref.

Descriptors: \*Incineration, \*Operation and maintenance, \*Sludge disposal, Temperature, Odors, Vibration, Design criteria, Waste water treatment. Identifiers: \*Start-up, \*Solids loading, \*Grease.

Four incinerators of the flash-drying type have been successfully used at Pittsburg, Pennsylvania since 1959. Problems encountered in the operation of these units have included odor problems, vibrational problems, and temperature control problems. Nearly all of the problems seemed insoluble at first, but the plant operators, in conjunction with the consulting engineers and the equipment manufacturer have managed to overcome all of them. The incinerators are presently operating at better than 90% of design capacity, and are disposing of some 28,000 dry tons per year of solids from a feed system containing 84% moisture. Incineration promises much wider application in the future due to stricter disposal criteria. Increased hours of operation at various locations will make it possible gather much needed operational information. (Lowry-Texas) W72-02660

# WASTE MANAGEMENT SYSTEMS FOR AD-

WASIE MANAGEMENT SISTEMS FOR AB-VANCED MILITARY BASES, Polytechnic Inst. of Brooklyn, New York. S. R. Qasim, N. L. Drobny, and B. W. Valentine. Water and Sewage Works, Vol 118, Ref. No. p R/92-R/100, 1971, 3 fig, 6 tab, 12 ref.

Descriptors: \*Design criteria, \*Cost-benefit analy-sis, \*Cost analysis, \*Waste water treatment, Ac-tivated sludge, Trickling filters, Oxidation lagoons, Chemical precipitation, Sludge, Biochemical oxygen demand, Transportation, Construction costs, Operation and maintenance.

Identifiers: \*Advanced military bases, \*Cost-effec-

tiveness survey, Package plants.

Acost-effectiveness study was performed to deter-Acost-effectiveness study was performed to determine the most cost-effective waste treatment unit for advanced bases. Criteria included: (1) environment (all but polar); (2) camp population — 500—1000 men; (3) BOD — 400 mg/l; (4) suspended solids — 400 mg/l; (5) hydraulic loading - 65 gpd/man; (6) sludge quantities — 92 lbs/day or 400 gpd for a 500 man camp and 184 lb/day or 800 gpd for a 1000 man camp; (7) 80% or more BOD and SC semoval; (6) Syx acquiringer life; (9) services. for a 1000 man camp; (7) 80% or more BDD and SS removal; (8) 5 yr. equipment life; (9) maximum shipment package size— 8x8x20 ft; and (10) max-imum shipment package weight — 25,000 lbs. A total of 11 different treatment processes available from 19 different manufacturers met the minimum criteria and were included in the cost-effectiveness analysis. Both construction and operating costs were included in the analysis. Data used was that supplied by the manufacturers. The entire selection process is presented along with evaluations from each segment. Based upon this analysis, the five most cost-effective systems for installation and use at the advanced military bases are: (1) oxidation ponds; (2) aerated lagoons using a plastic-lined earthen basin; (3) a chemical precipitation system; (4) a rotating biological contactor; and (5) a modified trickling filter with forced ventilation. (Lowry-Texas) W72-02663

## THE FIRST THING FIRST IS PREVENTIVE MAINTENANCE, Department of Public Works, Paramus, N. J.

J. J. Tedesco.

Public Works, Vol 101, No. 1, p 79, January 1970,

Descriptors: \*Waste water treatment, \*Sewers, \*Maintenance, Cleaning, Legislation, Data collection, Economics, Scheduling.

Preventive maintenance should begin with the completion of the sewer system. Even though a system is new, blockages will occur, and from a public relations standpoint alone, this is just the time complaints are not needed. Paramus, a city of 30,000 has 93 miles of sewer lines varying in size from 8 to 27 inches. Three of the five stages of sewer construction have been completed but the preventive maintenance program has already been started. The first item of equipment purchased was a Seweroder capable of eliminating blockages and performing mainline maintenance at a rate of 3,000 feet per day. This machine was able to clean up most of the after construction debris left in the lines, sheeting, bricks and rocks. Other items of equipment were added gradually, to reduce the strain on the budget. Eventually, the city acquired a reasonably complete line of sewer maintenance equipment and is able to handle all routine tasks. A schedule of preventive maintenance has been established and is performed by the city crews which complete a worksheet on each days activities. In this way a record of which portion of the system has been cleaned is maintained and any findings of the city crews concerning that part of the system is on file. With this equipment, the city can resolve problems as they occur and maintain the system in top condition. (Goessling-Texas) W72-02664

# INVESTIGATION ON SORPTION OF STRONTI-UM AND CAESIUM BY SOILS OF BORG EL-ARAB DISTRICT,

Atomic Energy Establishment, Inshas (Egypt). Nuclear Chemistry Dept.
M. Y. Farah, E. Metry, and S. Abdel-Gawad.

Health Physics, Vol 17, p 711-715, 1969, 3 fig, 3

Descriptors: \*Liquid wastes, \*Radioactive wastes, Soil chemical properties, \*Sorption, \*Strontium, \*Caesium, Hydrogen, Ion concentration, Tempera-

Identifiers: Borg El-Arab (U.A.R.), Exchange capacity, Distribution capacity, Selectivity coeffi-

#### **Group 5D—Waste Treatment Processes**

Studies were carried out to evaluate the effectiveness of Borg El-Arab soil samples for the concentration of fission products from liquid wastes. The sorption of caesium and strontium was investigated. With each isotope the exchange capacities of the carbon caesium and strontium was investigated. ty, distribution coefficient, and selectivity coefficient were determined. It was found that there was a continuous increase in the distribution coefficient for strontium sorption with increase in pH while caesium sorption reached saturation at pH7. The exchange capacity varied and was dependent on the type of soil and depth. Aluminum, calcium, and sodium exerted an effect on the distribution coefficient. The effect is related to the valence of the ca-tion; the higher the valence, the higher its compet-ing effect. The distribution coefficient of strontium and caesium was affected by heat treatment of the soil with a gradual decrease when the clay was heated at elevated temperatures, 400C. (Morgan-

KINETICS OF THE STEADY-STATE BACTERI-AL CULTURE III. GROWTH RATE,

AL CULTURE III. GROWIN BALE, Public Health Service, Annapolis, Md., and Rensselaer Polytechnic Inst., Troy, N. Y. L. J. Hetling, and D. R. Washington. Proceedings, Purdue Industrial Waste Conference, 20, May 4, 5, and 6, 1965, p 254-264, 6 fig, 1 tab,

Descriptors: \*Waste water treatment, \*Design, \*Bacteria, \*Growth rates, Chemical oxygen demand, Kinetics, Laboratory tests, Mathematical Identifiers: Batch cultures, Monod's equation.

One of the more important relationships in the design of a biochemical waste treatment process is the relationship between the rate of growth and the microorganism and the substrate concentration in the system. Monod attempted to clarify the situa-tion with his equation relating growth rate to substrate concentration and the growth rate constant. No data were available relating growth rate to the substrate concentration measured as COD. Laboratory studies using batch cultures, were undertaken to determine this relationship. The results of these investigations lead to the conclusion that the effective or observed growth rate is related to the maximum growth rate multiplied by a factor (Sc - A)/ (Sc PLUS B), where Sc is the substrate concentration (in mg/l) measured as COD and A and B are constants of the system. The experimental data indicate that the constants are unique to each combination of substrate and organism. However, it is felt that the general relationships apply to any predominantly microbial process. For an industrial waste treatment process the constants would be different for each waste, and would also be affected by any factor which would change the dominant species of organisms. At the present, insuffi-cient data are available to justify the presentation of the range of the coefficients involved. (Goessling-Texas) W72-02672

# REMOVAL OF SUBMICRON PARTICLES IN PACKED BEDS,

Maryland Univ., College Park. John T. Cookson, Jr. Environmental Science and Technology, Vol 4, No 2, p 128-134, 1970. 6 fig, 3 tab, 17 ref.

Descriptors: \*Filtration, \*Separation techniques, \*Particle size, Virus, Colloids, Mass transfer, Activated carbon, Adsorption, Waste water treatment, Water treatment. Identifiers: \*Isothermal.

The removal of viruses through packed beds and evaluation of the theory of mass transfer, based on the thin boundary layer solution of the diffusion for water filtration systems, was examined. Bac-teriophage T4 was removed in activated carbon beds under varying conditions of bed length, grain diameter, bed porosity, and flow rates. Under the

conditions studied, virus removals in the packed conditions studied, virus removals in the packed beds closely followed mass transfer theory. Colburn factor, j, varied with fractional void volume of the bed, but j was constant if the void fraction corrections of Pfeffer and of 1/E were applied, j also varied with bed heights, and longer column heights produced greater deviations from the theoretical equation. From these results, it was apparent that the particle transport mechanism in filtration theory may best be described by application of the mass transfer theory when diffusion is the limiting process for removal. (Lowry-Texas) W72-02673 W72-02673

#### FLUID BED INCINERATORS STUDIED FOR SOLID WASTE DISPOSAL.

Environmental Science and Technology, Vol 2, No 7, p 495-497, July 1968. 3 fig.

Descriptors: \*Solid waste disposal, disposal, Sewage sludge, Pilot plant, Industrial wastes, West Virginia.

Identifiers: \*Fluid bed incinerators, \*Power

generation, Screw feeders, Combustion techniques.

Although fluid bed incinerators have established themselves in the fields of sewage sludge and industrial waste incineration, the method is now being talked about as a means of attacking the solid refuse disposal problem. Studies conducted at West Virginia University were designed to show that fluid bed incineration can be a compact method for the clean combustion of solid waste materials. Some of the problems associated with applying this technique to the nonhomogeneous solid municipal waste are: (1) more efficient ways to remove ash and unoxidized materials from the bed are needed; (2) more efficient feeding methods need to be developed; (3) an air distribution that keeps solids of varying size and density in suspension in the bed needs to be maintained. At the pilot plant in West Virginia screw feeders are being studied and the use of piston feeders is also being considered. One solution suggested to the air distribution problem was the use of a packed fluidized bed, with larger particles falling through and traveling under the bed on an oscillating grate. Removal of ash and unoxidized material from the bottom of the bed would be accomplished by means of a pulsating air damper. The potential advantages that justify find-ing solutions to these problems are that fluid beds are compact devices, relatively simple to control and operate, cheaper to construct than grate-fed incinerators, combustion is rapid and complete, and a minimum amount of undesirable combustion products are produced. However, the need for low quantities of excess air is probably the major ad-vantage of the fluid bed. (Biggs-Texas) W72-02675

## ANAEROBIC SECONDARY TREATMENT OF POTATO PROCESS WASTEWATER, Cornell, Howland, Hayes and Merryfield/Hill, Cor-

vallis, Oreg. Industrial Processes Div.
R. E. Pailthorp, J. W. Filbert, and G. A. Richter.
Preprint of paper to be presented at Water Pollution Control Federation Conference, 44th, Session 22, No 3, October 7, 1971. 12 fig, 2 tab, 6 ref.

Descriptors: \*Industrial wastes, \*Canneries, \*Waste water treatment, Anaerobic sewage bacteria, Cost analysis, Potatoes. Identifiers: Potato process waste, Anaerobic filter, Anaerobic contact system, Vacuum degassifica-tion, Solids-liquid separation.

During the 1968-69 and 1969-70 potato processing seasons, two pilot scale anaerobic filters and an anaerobic contact system were used to demonstrate anaerobic treatability of potato processing wastewater. Four and eight foot deep anaerobic filters with 1 1/2 in rock filter media were tested. The anaerobic contact system included a contact reactor, vacuum degassifier, and a clarifier. Average BOD and COD removals for both filters were similar, 60 to 80 percent. Removals increased during the test period without regard to loading, temperature, or detention time. Removal efficiencies were higher during the second processing season. The anaerobic contact system averaged 60 percent BOD removal at a loading of 112 pounds of BOD per 1000 cubic feet per day. Effective (solidsliquid) separation was not achieved either with or without satisfactory, vacuum dessesification. The liquid) separation was not achieved either with or without satisfactory vacuum degasification. The solids level in the reactor approached 2000 mg/l, approximately half of the desired solids level. Changes in the clarifier did not improve the solidsliquid separation performance. The results of the study demonstrate that potato process wastewater is amenable to anaerobic biological treatment without an increase in the recession the recession the recession of the process waster temporal. without an increase in the process water tempera-ture or additional nutrients. However, the system is not promising for treating primary clarified potato process wastewater. Cost estimates for improved solids-liquid separation, by the methods tested, are too high for feasible application. (Morgan-Texas) W72-02676

SOIL ORGANIC MATTER AS A NATURAL CHELATING MATERIAL,
Temple Univ., Philadelphia, Pa.
A. Schatz, and V. Schatz.
Compost Science, Vol 11, No 5, p 28-31, September-October, 1970. 1 fig, 12 ref.

Descriptors: Solid wastes, Organic matter, Biodegradation, Chelation, Iron, Zinc, Copper, Molybdenum, Phosphates, Toxicity, Hydrogen ion concentration. Identifiers: Compost, Buffer.

One way to dispose of many solid organic wastes it to compost them, and then add the decomposed end product to the soil. This enriches the soil with organic matter which is what some soils need. Wellcomposted organic matter is in an advanced state of decomposition. Those compounds susceptible to microbial attack have already been oxidized, converted to resistant material or incorporated into cell material. What remains consists largely of complex substances with many carboxl and hydroxl groups which can chelate metals. By virtue of this ability to form metal complexes, organic material in compost affects the concentration of iron, zinc, copper, molybdenum and phosphates in the soil solution. To understand soil fertility we must think of plant nutrients in the soil much as we think of acidity in terms of pH. Organic matter is therefore an important factor in soil fertility, just as it is in soil formation, because it maintains the soil in a proper homeostatic state. It also removes heavy metals and thereby serves as a means of detoxification. These are the mechanisms by which organic matter in the soil, be it naturally occurring or added in compost, assist in developing and maintaining fertility. (Goessling-Texas)
W72-02677

#### SECONDARY WASTE TREAT-NUTRIENT AND AERATION STUDIES, TREATMENT-St. Regis Paper Co., Pensacola, Fla

J. C. Tracy. Southern Pulp and Paper Manufacture, Vol 33, No 2, p 46-51, February 10, 1970. 9 fig, 1 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Pulp and paper industry, Laboratory tests, Aerobic treatment, Nutrient requirements, Nitrogen, Phosphorus, Data collection, Design,

Practically every major manufacturing industry seems to be faced with some pollution problem; and with few exceptions, we of the paper industry are faced with a maze of problems associated with both air and water pollution and its abatement. In order to provide assistance to our engineering groups in planning future secondary treatment system, limited bench scale and pilot scale treata-bility studies were conducted. The following are some of the more significant factors derived from the study. (1) Nutrient requirements were established. We were deficient in both nitrogen and phospi sions f or nuti tant fa metho be pre gineer based treatm W72-0

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#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Waste Treatment Processes—Group 5D

phosphorus and future system should have provisions for nutrient additions. (2) Excessive aeration or nutrient additions accomplish very little. (3) Acclimated biological forms should be beneficial, and future studies should include seeding as an impor-tant factor. (4) Bench scale data agree well with pilot scale system data. Obviously the bench scale method is more versatile and less costly, so it may be preferred in most cases. St. Regis is currently engineering a secondary waste treatment system based on the results of these studies. We were able to indicate the required detention time, aeration horsepower and nutrient additions for the desired treatment (Goessling-Texas) W72-02678

DETOXIFICATION OF CYANIDE BY ADSORP-TION AND CATALYTIC OXIDATION ON GRANULAR ACTIVATED CARBON,

Calgon Corp., Pittsburg, Pa. F. E. Bernardin.

Preprint of paper to be presented at Water Pollu-tion Control Federation Conference, 44th, Session 22, No 1, October 7, 1971, p 1-36. 8 fig, 11 tab, 13

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Chemical wastes, \*Activated carbon, Chemical oxidation, Chemical hydrolysis. Identifiers: Cyanide wastes, Metal plating wastes, Cyanide oxidation, Cyanate hydrolysis, Coke plant wastes, Metal-cyanide complexes, Copper wastes, Zinc wastes, Cadmium wastes.

Activated carbon will catalyze the oxidation of cyanide (CN-) to cyanate (CNO-) by dissolved oxygen. The presence of cupric (CU....) ions result in the formation of copper cyanides which adsorb to a greater extent than copper or cyanide alone. The copper may be impregnated onto the carbon, or fed continuously to a bed of virgin carbon. The oxidation of cyanide to cyanate does not require continuous copper addition; however, continuous ad-dition at the recommended feed ratio of one to one on a weight basis with cyanide will cause cyanate hydrolysis to ammonia and carbonate in water. The reaction products of cyanate hydrolysis combined with the cupric ion to form precipitates that can become objectionable with respect to head loss or migration, but can be removed and the copper recovered by dissolution with acid. The process has been shown to work on copper, zinc, cadmium, and coke plant wastes when oils and tars which foul the carbon surface are removed. Also, the prevention or removal of excess iron contamination which forms oxidation-resistant complexes is necessary. Low influent suspended solids, extraneous metals a pH between 6.5 and 8.0, constant copper feed and a sufficient level of oxygen (dissolved oxygen present in the system effluent) are required to achieve maximum efficiency. (Morgan-Texas) W72-02679

NOVEL BIOLOGICAL TREATMENT PROCESS UTILIZES UNIQUE REDWOOD MEDIA, Cornell, Howland, Hayes and Merryfield, Corvallis,

Oreg. F. D. Schaumburg, and S. Lasswell.

Water and Wastes Engineering, August 1970, p 34-37. 3 fig, 1 tab.

Descriptors: \*Waste water treatment, Trickling filter, Activated sludge, Pilot plant, Municipal wastes, Biochemical oxygen demand, Suspended load, Carbohydrates, Organic loading. Identifiers: Redwood slat media, Recycle ratio,

The Del-Pak Corp. recently introduced the redwood slat biological media using rough sawn redwood slats. It has double the void percentage and slightly more specific surface than 4 in diameter rock media. A pilot plant investigation was undertaken in 1960 to evaluated this media as a dertaken in 1969 to evaluated this media as a biological support media in a process designated as a biological support media in a process designated as the Activated Biofilter (ABF). The redwood media was packed in a tower 21 feet high and 3 feet by 3 feet in cross-section. The tower was followed by a teet in cross-section. The tower was concerned by a 1,200 gal. clarifier equipped with a sludge recycling pump. Influent from a primary settling basin was introduced at a rate of 9 gpm, underflow from the filter was recycled at a rate of 13.5 gpm and sludge was recycled from the secondary clarifier at a rate of 4.5 cm. A accord advancing was conclusive to of 4.5 gpm. A second experiment was conducted to of 4.3 gpm. A second experiment was conducted to determine the efficiency of this media as a conven-tional high rate trickling filter. The ABF process can be expected to produce a high quality effluent in terms of BOD at loadings up to 200 lb BOD per day per 1000 cu. ft. and with a MLSS of 3000 to 6000 mg/l. Shock organic loads and wastes containing significant quantities of carbohydrates can apparently be treated by the ABF process without severe reduction in efficiency. The ABF appears to combine the most desired characteristics of the trickling filter and the activated sludge processes and represents an important advancement in waste treatment technology. (Goessling-Texas) W72-02681

# MUNICIPAL WASTEWATER SURVEY AND

ANALYSIS.
Coastal Bend Regional Planning Commission, Corpus Christi, Tex.

Available from the National Technical Information Service as PB-201 198, \$3.00 in paper copy, \$0.95 in microfiche. Water Quality Study Report 1-A, May 1971. 97 p.

Descriptors: \*Planning, \*Surveys, Treatment facili-ties, Sewers, Operation and maintenance, Labora-tory tests, Sludge, Municipal wastes, Waste water treatment, Data collection, River basin development, Texas.
Identifiers: Coastal Bend Regional Planning Com-

As a preliminary step in the development of a regionalized wastewater treatment scheme, 12 counties, covering portions of the lower Nueces River Basin, the San Antonio-Nueces Coastal Basin, and the Nueces-Rio Grande Coastal Basin, were surveyed to determine the extent of existing facilities and the type of treatment these facilities were providing. Counties included were Aransas, Bee, Brooks, Duval, Jim Wells, Karnes, Kleberg, Live Oak, Nueces, Refugio, and San Particio. Each individual waste treatment plant in the respective counties was visited, and in most case the plant operator or superintendent was questioned on operational details and flow diagrams. Lack of flow meters, laboratory equipment, and qualified personnel greatly handicapped the gathering of operational data for most installations. A thorough description of the collection system, location, plant description, operations and proposed improve-ments, as well as any available laboratory data is in-cluded for each treatment plant studied. (Lowry-Texas) W72-02683

#### WASTEWATER REUSE.

National Water Commission, Arlington, Va. Jerome Gavis.

Available from the National Technical Information Service as PB-201 535, \$3.00 in paper copy, \$0.95 in microfiche. National Water Commission Report No. NWC-EES-71-003. 164 p, 6 tab, 126 ref.

Descriptors: \*Water reuse, \*Water resources development, \*Tertiary treatment, Water purification, Planning, Legislation, Water quality control, Nutrients, Cost analysis, Waste water treatment. Identifiers: \*Industrial reuse.

Gross use of water by the manufacturing industry in the U.S. in 1965 was 90,000 mgd. Only 40.000 mgd was withdrawn from natural sources, so each gallon of water was, on the average, circulated 2 1/4 before being discharged or consumed. Industry then, is an obvious candidate for water reuse since it is already practicing it to a large degree. Use of treated wastewater for industrial uses on an 80% basis would liberate an additional 32,000 mgd for

personal consumption. Technology needed to acpersonal consumption. Technology needed to accomplish complete recycling is currently available, but implementation is slight, even though it is cheaper to produce drinking quality water from wastewater than from seawater. Further research in the constant of the constan wastewater that from seasurer. Further research the establishment of chemical and virological standards for potable supply will hopefully tend to overcome the esthetic objections and promote acceptance of reclaimed water. At the same time, increased stringency in discharge standards will also amount to a decrease in pollution of lakes and streams. Cost reduction and decreased complexity will make advanced treatment ever more attractive and establish it as a major factor in the Nation's water resources in the future. (Lowry-Texas) W72-02684

SIMPLE SYSTEM FOR AERATING MANURE

DeKalb AgResearch, Inc., Ill.

Jay Gilliland.

Poultry Digest, Vol 29, p 330-331, July 1970. 1 fig.

Descriptors: \*Farm wastes, \*Poultry, \*Sedimentaitation, \*Aeration, Anaerobic conditions, Aero-bic conditions, Odors, Sulfides, Methane, Con-struction costs, Operation and maintenance, Cost analysis, Erosion, Waste water treatment.

An aerated lagoon system was designed to treat the 1780 cu. yds of manure produced annually by two 30,000-hen automatic environmental controlled laying houses, instead of relying on spreading the manure on the land. A 100 ft by 200 ft lagoon with a12 ft. depth and a two-to-one side slope was con-structed at a cost of \$900, having an estimated 10 year life. A six nozzle irrigation sprinkler run by a centrifugal irrigation pump with a 5 hp motor provides aeration at a cost of \$2.20 per day. Water is drawn from just below the surface and sprayed into the air in order to reduce odors. The methane and hydrogen sulfide gases generated by anaerobic action on the lagoon bottom are dissipated by aerobic bacteria near the top and their odor eliminated. This method has been demonstrated to be a low costs disposal, low cost upkeep system particularly suited for this job. (Lowry-Texas) W72-02685

POLLUTION IN ALABAMA Auburn Univ., Ala. Dept. of Civil Engineering.

Available from the National Technical Information Service as PB-201 445, \$3.00 in paper copy, \$0.95 in microfiche. Report for the Alabama Environmental Conference, September 1970. 89 p, 14 fig,

Descriptors: \*Alabama, \*Water pollution control, \*Air pollution, Industrial wastes, Municipal wastes, Surveys, Population, Legislation, Cost analysis,

A collation of existing data, with the addition of qualitative information gained from questionnaires, interviews, and personal observation was conducted in an attempt to provide an inventory of the status of pollution control in Alabama. 318 municipalities varying from 37 to 300,000 population and representing 1,970,000 people or 60% of the state's total population, were questioned, and 117 responses received which were representative of 72% of the population questioned. Data requested included information about wastewater treatment methods and focilities for both industrial and must be and for the formation of the foliation of methods and facilities for both industrial and municipal wastes, air pollution sources, control measures, and emissions requirements and future regulations, planned expansions and improvements in all areas. Many areas and their industries are making excellent progress, and proposed legislation to provide stiffer penalities for non-compliance to control ordinances is expected shortly. In most ci-ties, control of only 4 or 5 industries can result in marked improvement in environmental quality. Slow population and industry growth have made the clean-up task much easier and predictions are that if each citizen is willing to help, clean water

#### **Group 5D—Waste Treatment Processes**

and clear skies should be prevalent once again by the mid 1970's. (Lowry-Texas) W72-02686

CHLORINATION FOR CONTROL OF BAC-TERIA AND VIRUSES IN TREATMENT PLANT

EFFLUENTS, Robert A. Taft Sanitary Engineering Center, Cin-cinnati, Ohio. Cincinnati Water Research Lab. Cecil W. Chambers.

J Water Pollut Contr Fed. 43 (2): 228-241. Illus. 1971.

Identifiers: \*Bacteria, Chlorination, Coliforms, Control, Effluents, Plant, Treatment, \*Viruses.

Many treatment systems will be required to disinfect effluent to meet water quality standards when federal and state regulations are implemented and enforced. This paper is concerned with the purpose, effectiveness, and limitations of chlorination for the control of bacteria and viruses in waste water effluents. The fundamentals of chlorine chemistry are presented. Hypochlorous acid (HOCl), is an extremely potent germicide at pH 6.5 to 7.5; however, it reacts with ammonia rapidly and is converted to less germicidal chlorine addition products. The effect of pH and temperature on dis infecting efficiency is discussed. The susceptibility of the more resistant enteric bacterial pathogens. free chlorine, and chloramine is discussed. Literature on the effect of chlorination of pathogens present in waste water is reviewed and discussed. The data from a survey of plants at all levels of operating efficiency are presented. Data on the use of the coliform test, chlorine dosage, contact time, and coliform content/100 ml are included. Thirteen general guidelines to the practical disinfection with chlorine of waste water effluents are presented.--Copyright 1971, Biological Abstracts, Inc. W72-02706

EFFECT OF INITIAL BIOLOGICAL SOLIDS CONCENTRATION AND NITROGEN SUPPLY ON METABOLIC PATTERNS DURING SUB-STRATE REMOVAL AND ENDOGENOUS METABOLISM.

Florida State Dept. of Air and Water Pollution

Control. Tallahassee.
G. J. Thabaraj, and Anthony F. Gaudy, Jr.
J Water Pollut Contr Fed. 43 (2): 318-334. Illus.

Identifiers: Activated, Biological, Concentration, Endogenous, Industrial, Metabolic, Metabolism, \*Nitrogen, Patterns, Sludge, Solids, Substrate, Treatment, Waste, Water.

Nitrogen-deficient industrial wastes may be treated by the activated sludge process modified by metabolically removing soluble carbon sources from solution and using them to synthesize nonnitrogenous cellular products. This permits the system to act kinetically and metabolically like one to which no nitrogen has been added. Substrate removal by heterogeneous microbial populations depend on the initial carbon source: biological solids ratio. Research results indicated that if a nitrogen-deficient industrial waste were treated using a continuous oxidation assimilation process and the waste studge were treated by aerobic digestion, adding a small amount of nitrogen source to the aerobic digester could accelerate the digestion process.—Copyright 1971, Biological Abstracts, Inc. W72-02708

HIGH-RATE DIGESTER LOADINGS,

Bergen County Sewer Authority, Little Ferry, N. J. Herman R. Zablatzky, and George T. Baer, Jr. J Water Pollut Contr Fed. 43 (2): 268-277. Illus.

Descriptors: \*Waste water treatment. Identifiers: \*Digester, High, Loadings, Rate.

Investigations were conducted in Bergen County, N. J., to develop guidelines for operating the digesters at higher loadings. Conclusions reached digesters at higher loadings. Conclusions reached were to design for: average daily loading of 0.5 lb undigested solids/day/cu ft of effective capacity (0.27 kg/day/cu m), assuming 72% volatile solids; 10-day minimum detention; 4 to 8% concentration of combined undigested primary and waste activated sludge; and an operation temperature range of 85 to 95 deg F (29.4 to 35 deg C). Guidelines were formulated for operation using these design criteria.—Copyright 1971, Biological Abstracts, Inc. W72-02710

EXTENDED AERATION IN BRITISH

PACKAGE PLANTS, Secretary of State for Scotland, Edinburgh. Scottish Development Dept. Eric H. Nicoll.

J Water Pollut Contr Fed. 43 (2): 293-305. Illus.

Identifiers: Activated, \*Aeration, British, Extended, Package, Plants, Sludge, Treatment, Waste

The main types of activated sludge waste water treatment plants providing for a long period of aeration are described. General provisions and design factors that form an acceptable basis in Great Britain for schemes submitted for loan sanction or for consideration for grant are summarized. Design criteria are discussed and practical advice is offered on installation, operation, and maintenance. Various other aspects are examined in-cluding the selection of the treatment process, noise, surface water and subsoil water, standby equipment, sludge production and desludging, effluent polishing, aeration requirements, and upward flow velocities. Scale effects and aspects of load variation are considered. Formulas and diagrams are derived relating the various design an operational control parameters.--Copyright 1971, Biological Abstracts, Inc. W72-02711

PESTICIDES IN WATER: CHLORINATED HYDROCARBONS PESTICIDES IN IOWA

RIVERS, Iowa Univ., Iowa City. State Hygiene Lab. Lauren G. Johnson, and Robert L. Morris Pestic Monit J. 4 (4): 216-219, 1971. Identifiers: Carbon, Chlorinated, \*DDE, \*DDT, Dieldrin, Hydro, Iowa, Pesticides, Rivers, Runoff.

The routine monitoring of a number of Iowa rivers for chlorinated hydrocarbon pesticides over a 3-yr period has shown the presence of dieldrin, DDT, or DDE in the majority of the samples taken. Dieldrin has occurred more frequently and in higher concentrations than either of the other residues, and this is attributed to the amount of agricultural ac-tivity in the watersheds involved and to the amount of surface water runoff .-- Copyright 1971, Biological Abstracts, Inc. W72-02712

FEASIBILITY OF LIQUID ION EXCHANGE FOR EXTRACTING PHOSPHATE FROM WASTEWATER,
General Mills Chemicals Inc., Minneapolis, Minn.

LeRoy Ditsch, Ronald Swanson, and Albert J.

Copy available from GPO Sup Doc EP2.10:17010EAP10/70, \$0.50; microfiche from NTIS as PB-205 360, \$0.95. Environmental Protection Agency-Water Quality Office, Water Pollution Control Research Series, October 1970. 40 p, 4 fig, 7 tab, 17 ref. EPA Program 17010 EAP, Contract 14-12-590

Descriptors: "Prosphates, "Ion exchange, "Separa-tion techniques, Laboratory tests, Analytical techniques, Hydrogen ion concentration, Alkyl benzene sulfonates, Chlorides, Aluminum, Iron, Oxidation, "Waste water treatment. Identifiers: "Organometallics. Descriptors: \*Phosphates, \*Ion exchange, \*SeparaThe liquid ion exchange extraction process has been used consistently for removing small quantities of uranium, vanadium, copper and other metals. In successful tests of the ability of liquid ion exchange to remove ABS from sewage plant effluents, it was discovered that some phosphorus was removed also. Various metal-containing organic compounds were esteed for their activity as liquid ion exchange reagents for phosphate. The compounds were tested for selectivity in extracting inorganic phosphate from water into organic solvents in the presence of chloride, sulfate, and bicarbonate. A tribenzyltin hydroxide, with a component identification as containing tribenzyltin carbonate and a tribenzyltin carboxylic acid salt, extracted 52% of phosphate from an aqueous solution bonate and a tribenzylini caroxylic acid sait, ex-tracted 52% of phosphate from an aqueous solution containing 25 mg/l phosphate, 166 mg/l chloride, and 212 mg/l sulfate at pH 4.1. A tribenzyltin acetate compound was also successful in extracting phosphate but the extraction was not as complete with the tribenzyltin hydroxide compo as with the tribenzyltin hydroxide compounce Tribenzyltin benzoate, triphenyltin hydroxide and several others, as well as trivalent iron, aluminum and chromium salts of di-2-ethylhexylphosphoric acid did not exhibit any significant phosphate ex-tracting activity. (Lowry-Texas) W72-02810

EFFECT OF TEMPERATURE ON AEROBIC DECOMPOSITION OF DAIRY CATTLE

Purdue Univ., Lafayette, Ind. Dept. of Agricultural

Engineering.
J. C. Nye, A. C. Dale, and D. E. Bloodgood.
Transactions of the ASAE. Vol 14, No 3, p 545-48, May-June, 1971. 8 fig, 3 tab, 7 ref.

Descriptors: \*Farm wastes, \*Aerobic treatment, \*Waste disposal, \*Livestock wastes, Ruminants, Sewage disposal, Oxidation, Cattle. Identifiers: Phenyl pyruvic acid.

Temperature has an effect on the aerobic biodegradation of ruminant fecal wastes, which are about 25% lignin and protein, and 25% undigested feed and bacterial cells. A manure mixture of 2 parts feces and 1 part urine was fed into five decomposition chambers at a rate of 90 grams per 6 liters per day. After 28 days, batch feeding replaced daily feeding in the chambers which ranged in temperature from 35 to 75F. On the 74th day the entire contents of the chambers were dried. day the entire contents of the chambers was stopped, the when semi-continuous feeding was stopped, the solids concentration of the supernatant decreased to a minimum of 4000 mg/l in the warmest chamber. As this minimum was reached the pH dropped from 7.8 to 5.7 in seven days. This may have been caused by the formation of phenyl pyru-vic acid as lignin was transformed to humos. In an aerobic system with a detention period of 74 days at temperatures above 65F, a reduction in volatile solids of 70 percent can be attained. In the same type of system at 48F, only 45% reduction of volatile solids is attainable. A definite change in the rate of decomposition of volatile solids and COD seems to occur between 48F and 56F. (Schmitt-W72-02835

A YEAR IN THE LIFE OF A SLURRY COM-POUND.

Agriculture, Vol 78, No 6, p 268-269, June 1971.

Descriptors: \*Farm waste, Cattle, Surface runoff, Slope, Economic feasibility, Waste storage, Storage capacity, Porosity, Odor, Waste disposal. Identifiers: \*Dairy cattle, Slurry compound, Slurry disposal, Feed ration.

To eliminate the difficulty of spreading the slurry compound from a dairy farm in northern Chilterns, a storage tank to hold the full winter's storage of slurry was built. The system was built for an operation of sixty Friesian milkers. The storage area, 90 ft. long and 66 ft. wide, was excavated to an average depth of 2 ft. which produced sufficient flinty clay material to form the side and end walls.

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#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Waste Treatment Processes—Group 5D

The excavated clay was used to built a bank around the area which would hold the slurry to a depth of about 3 to 4 ft. The disposal system was reasonably cheap to install, operate, and maintain and it avoided the daily or weekly chore of manure disposal in the winter. No smell, fly or other nuisance arose during the period of storage in the compound. On emptying, the smell, although powerful, was of limited duration. The amount of percolation into the subsoil appeared to be negligible on account of the clay-based subsoil forming the floor of the compound. In calculating the storage capacity of the slurry compound, it seems prudent to be on the generous side. Half a cubic yard per cow per week for the winter housing period is a useful guide. (Bundy-lowa State)

POULTRY WASTE HANDLING SYSTEMS,

Cornell Univ., Ithaca, N. Y. Dept. of Poultry Science.

Poultry Digest, November 1971, p 529-532.

Descriptors: \*Farm waste, \*Odors, Drying, Aerobic, Anaerobic, Poultry, Oxidation lagoons, Design, Effluents, Waste water disposal, Fertilizer, Hydraulic structures, Waste management. Identifiers: Storage capacity, Plow-down application, Laying cages, Deep pits.

The problems of waste management have become increasingly important primarily because of increasing in flock size, concentration of birds and population migration to the country. There are several waste handling systems, none of which is adaptable to all situations. Some of the more popular types of waste handling systems are: (1) deep pits which are capable of handling at least 6 to 9 months storage, (2) hydraulic systems with aerated lagoon, and (3) oxidation ditches. Spreading of slurry taken from the storage pits also creates problems, if not handled properly. If liquid spreaders are used, the spreaders should be enclosed to reduce odors on public roads and on other property. In the spreading of manure by the use of plow-down application method, the material is poured into the furrow followed up by plowing. The soil being a very good filter, reduces the odors. Regardless of the practice followed in handling waste products, care should be taken to avoid a poor image in the community. (Bundy-lowa State) W72-02842

#### AIR POLLUTION FROM AGRICULTURE.

Nebraska Univ., Lincoln. Coll. of Agriculture. L. F. Elliot, and T. M. McCalla.

Proceedings, Exploring Nebraska's Pollution Problems, symposium article No 31275; Journal Series, Nebraska Agricultural Experiment Station, April 22, 1971. p 1-6, 29 ref.

Descriptors: \*Farm wastes, \*Air pollution, \*Dusts, \*Odor, Aesthetics, Erosion control, Land management, Weed control, Pesticide drift, Dust storms, Wind erosion, Pollen, Smoke.

Identifiers: \*Allergens, \*Fatty-acids, Aerosol drift, Ragweed pollen, Stubble mulching.

The major atmospheric pollutants from agriculture are dust, allergens, odors, pesticides, and smoke. The reduction of these pollutants through improved management practices can be demonstrated. Dust can be controlled by proper cropping systems and management. Allergens can be decreased by weed control. If the surface of animal wastes is maintained aerobically, little or no odor will exist. Problems in reducing odor production in animal confinement units are discussed along with known odor causing chemicals present in these units. However, the control of odors by chemicals are usually of short duration and the chemicals are prohibitively expensive. (Dorland-lowa State) W72-02844

BOD POSES PROBLEMS FOR POULTRY GROWERS AND PROCESSORS, Griffith (Llewellyn B.), Falls Church, Va.

Oriffith.

Water and Sewage Works, Vol 117, No 1, p 1IW/9-IW/14, Jan-Feb 1970. 1 fig, 3 tab.

Descriptors: \*Farm waste, Poultry, Biochemical oxidation demand, Organic matter. Identifiers: \*Poultry processing plant, Broilers, Live weight, Blood waste.

The BOD from poultry processing plants and parameters by which it can be estimated with meaningful accuracy are necessary when designing facilities. Graphs plotted from the data consistently produce a curve whose slope is upward as the size of the bird processed is increased. The BOD load cannot be expressed accurately in terms of production units of either head count or gross live-weight unless the average live-weight per bird processed is considered. The available data is not considered to estificiently comprehensive to permit precise calculation of BOD loads imposed by the larger birds of today, but it is adequate to raise a warning flag which should alert those involved to the probability that treatment plants designed according to the old criteria may be underdesigned by a factor of two where 4 lb. birds are being, or soon will be, processed. (Bundy-lowa State)

CHEMICAL AND MICROBIAL STUDIES OF WASTES FROM BEEF CATTLE FEEDLOTS, Agricultural Research Service, Lincoln, Nebr. Soil and Water Conservation Research Div. T. M. McCalla, and F. G. Viets, Jr.

Proceedings: Pollution Research Symposium, May 23, 1969. Typescript, 24 p, 14 tab, 77 ref.

Descriptors: \*Microorganisms, Chemical properties, Cattle, Farm wastes, Odor, Runoff, Confinement pens.
Identifiers: Great Plains. Nebraska, Feedlot.

Chemical and microbial characteristics of beef cattle waste are discussed along with some of the possible microbial and chemical transformations that reduce the disposal problem. The cattle feedlot waste depends on the ration feed. Generally, cattle in feedlots are started on a high-roughage ration and quickly shifted to a high-concentrate one. A high-concentrate ration has about 75% to 85% digestible material and 5% to 7% minerals, resulting in 4 to 5 lbs. of feces per animal per day. Pollution of groundwater beneath beef cattle feedlots appears to be determined by a number of factors; namely, stocking rate, manure removal, depth of water table, and soil texture and structure. Indications are that low stocking rates and frequent manure removal contribute to nitrate leaching into the water table. Also, feedlots in which the groundwater is relatively close to the surface are more apt to contain nitrate in excess of 10 ppm than are feedlots with a deeper water table. Beef cattle feedlots established on coarse-textured, sandy soils may permit more movement of pollutants to the groundwater than those established on fine-textured clay soils. (Dorland-lowa State) W72-02847

PHOTOSYNTHETIC RECLAMATION OF AGRICULTURAL SOLID AND LIQUID WASTE, California Univ., Berkeley. Sanitary Engineering Research Lab.

G. L. Dugan, C. G. Golueke, W. J. Oswald, and C. E. Rixford.

SERL Report No 70-1, May 1970. 165 p, 55 tab, 24 fig, 51 ref. USPHS 5 R01 U1 00566-03.

Descriptors: \*Farm waste, \*Poultry, \*Oxidation lagoons, Nutrients, Aquatic algae, Nitrogen, Anaerobic digestion, Aerobic, Alkalinity, Acidity, Laboratory, Digestion tank, Pondage, Pilot plant, Settling basin.
Identifiers: \*Detention period, Flushing operation,

Acid injection pump, Alum injection pump, Manure grinder. The research plan on which the grant was based and reported called for laboratory and pilot plant studies to develop a partially-closed system of animal waste management based on the integration of an anaerobic and an aerobic phase, the recycling of water, and the reclamation of a usable product. Contained herein are: a review of the laboratory and 'pre-pilot plant' studies described in a progress report (1) issued during the second year of the study, and a full account of pilot plant studies completed at the time of this writing. The pilot plant includes a poultry enclosure, a hydraulic system for handling the wastes, a heated anaerobic digester with auxiliary equipment, and an algae-production pond. (Bundy-lowa State)

ENGINEERING PRINCIPLES IN HANDLING LIQUID MATERIALS,
Michigan State Univ., East Lansing. Dept. of

Michigan State Univ., East Lansing. Dept. Agricultural Engineering. C. M. Hansen.

Agricultural Engineering, Vol 39, p 546-551, Sept 1958. 13 fig, 1 tab, 8 ref.

Descriptors: \*Farm wastes, \*Fertilizers, \*Pumps, Hydraulic equipment, Liquid wastes, Liquids, Pesticides, Spraying, Herbicides, Hogs, Nematocides, Measurement, Centrifugal pump, Farm equipment, Cattle.

equipment, Cattle. Identifiers: \*Dairy cattle, Anhydrous ammonia, Rotameter, Aqua ammonia, Liquid feeds, Helical

Various methods of handling liquid fertilizer, liquid feeds, pesticides, nematocides, and liquid manure are discussed with special emphasis given to the type of pumps recommended for each. Anhydrous ammonia is usually transferred by a bleeding system or a vapor-return system. It is commonly applied to the soil by employment of the pressure differential system. Aqua ammonia is transferred by centrifugal pumps as are many herbicides. Pesticides are recently being applied with air-blast pumps which use both air and water as a carrier of the pesticide. A most successful hydraulic pump for handling soil fumigants has the nylon roller impeller. This pump needs to be flushed with Kerosene or Stoddard solvent. The helical rotor pump with a rubber or synthetic rubber stator is a new pump for handling liquid manure in the semisolid form. By pumping semisolids, a Missouri farmer is able to weekly flush the wastes from a 350-hog installation with only 2,500 gallons of water. Dairy cow wastes are also a semisolid, as 56% of the 12-15 gallons per day water consumption is excreted in the reces while only 13% is excreted in the urine. (Schmitt-lowa State)

LIMNOLOGY OF THE IOWA REACH OF THE MISSISSIPPI RIVER, Iowa Univ., Iowa City. State Hygiene Lab.

Iowa Univ., Iowa City. State Hygiene Lab. For primary bibliographic entry see Field 05G. W72-02937

AUTOMATIZATION OF URBAN WATER-WORKS IN THE SOVIET UNION,
Polish Association of Sanitary Engineering and

Polish Association of Sanitary Engineering and Technology, Warsaw.

Janusz Drozdz.

Gaz Woda Tech Sanit. 44 (10): 332-334. Illus. 1970.

Identifiers: Automatization, Urban, USSR, Water-Works.

Description of automatization measures in the USSR are given. The following were of greatest interest: application of typical industrial controlling stations for pumping stations, automization of the preparation and dosage of the coagulant as depending upon the content of the reagent in the water, use of automatic measuring/control apparatuses for water quality, automatic rinsing of filters in stations equipped with electrical and hydraulic fittings, use of automatic regulators of output, and use of teletechnical equipment for command guidance of

#### **Group 5D—Waste Treatment Processes**

water-works.--Copyright 1971, Biological Abstracts, Inc. W72-02938

#### 5E. Ultimate Disposal of Wastes

HOUSE FLY PUPAE AS FOOD FOR POULTRY, Agricultural Research Service, Beltaville, Md. C. C. Calvert, R. D. Martin, and N. O. Morgan. Journal of Entomology, Vol 62, No. 4, August 1969, p 938-939, 2 tab, 2 ref

Descriptors: \*Waste disposal, \*Organic matter, Proteins, Poultry, Foods, Nutrients, Soybeans, Laboratory tests.

Laboratory tests.
Identifiers: \*House flies, Pupae, Fats, Waste utilization.

A study was conducted as a part of the waste utilization program to determine if the larvae of the house fly could be used to produce protein and fat from human wastes. Due to the difficulty of collecting sufficient larvae for this experiment, fly pupae were used. Pupae were obtained from a culture that had been maintained at the Beltsville Fly Control Laboratory for 60 generation and held at -10LC until needed. The pupae were dried, ground in a small Wiley mill and analyzed for protein, fat, ash, moisture and other substances. The composition of the amino acid indicated that the protein was of a quality similar to meat or fish meal. In two separate 2 week tests, day old chicks were fed one of two formulations containing fly pupae as a protein and fat source. The results indicate that the fly pupae provided enough protein of sufficient quality to support normal growth of chicks during the first two weeks of life. This study is preliminary and more work is required before a valid comparison can be made with the soybean meal now used. It is conceivable that the house fly could be used to convert waste materials into usable, high quality ing some of the problems of organic waste disposal. (Goessling-Texas) (Goessling-Texas) W72-02383

DISPOSAL OF WASTES FROM WATER TREATMENT PLANTS-PART 3-SECTION 2, REPORT ON CURRENT TECHNOLOGY AND COSTS.

For primary bibliographic entry see Field 05D.

W72.02390

SLUDGE INCINERATION AT JERSEY CITY, NEW JERSEY.

Jersey City Sewerage Authority, N.J. For primary bibliographic entry see Field 05D. W72-02410

MARKETING SUCCESS DEPENDS ON SALES ORGANIZATION,
Auckland City Council (New Zealand).

Auckland City Council (New Zealand). For primary bibliographic entry see Field 05D. W72-02416

CHICAGO CONTINUES SLUDGE, COM-PACTED WASTE RESEARCH.

Compost Science, Vol 11, No 1, January-February 1970. p 16.

Descriptors: \*Sludge disposal, \*Solid wastes, Farms, Crops, Forestry, Pipeline, Pumping, Illinois. Identifiers: Bailing solid wastes, Rail-haul, \*Chicago, \*Waste utilization.

Two waste projects at Chicago are arousing interest. The first is a project to discover everything there is to be discovered about compacting solid wastes into stable bales for rail-haul to a suitable landfill site. The second is a continuing investiga-

tion into the possible uses of sewage sludge with the objective of intelligently, economically and benefically disposing of this residue. Tree nurseries have been started and crops were planted on soil which has been heavily treated with sludge. Sludge is being sprinkled on parkland, grass lining the highways system and in other selected sports. It is available free to any park, golf club or industrial group interested in trying it. The purpose of these projects is to prove the utility of sludge in treating land and in reclaiming unusable land. Engineers have been working on a pipeline to transport sludge to areas where safe, useful disposal can be made. (Goessling-Texas)

COMPOSTING TREE BARK, WITH SEWAGE. For primary bibliographic entry see Field 05D. W72-02427

OCEAN DUMPING POSES GROWING THREAT.

Environmental Science and Technology, Vol 4, No. 10, p 805-806, October, 1970.

Descriptors: \*Oceans, \*Sludge disposal, \*Public health, Municipal wastes, Industrial wastes, Chemical wastes, Radioactive wastes, Cost analyses, Water quality control, Legislation, Waste water treatment.

48MILLION TONS OF WASTES WERE DISPOSED OF IN THE OCEAN DURING 1968 AT A COST OF \$29 million. The tonnage of wastes disposed of in the ocean has grown fourfold over a 20 year period and is expected to increase exponentially in the future. The seven major waste categories, in order of decreased tonnage per year, are: (1) harbor dredgings; (2) industrial wastes; (3) municipal wastes; (4) refuse and garbage; (5) construction and demolition debris; (6) military explosives and chemical wastes; and (7) miscellaneous. All wastes reaching the oceans through sewer and sewer sludge outfalls are excluded. Disposal costs of from \$1/ton to \$600/ton were reported for the various wastes. Little of the long-term or short-term effects of ocean dumping are known, but studies presently underway have indicated health hazards near areas where extensive dumping is practiced. Legislation has been introduced to ban ocean dumping, but no laws have been enacted as yet. (Lowry-Texas)

REFUSE STABILIZATION IN THE LAND,

California Univ., Davis. S. A. Hart, W. J. Flocker, and G. K. York. Compost Science, Vol 11, No. 1, p 4-8, January-February, 1970, 7 fig, 2 tab, 4 ref.

Descriptors: Solid wastes, Municipal wastes, Incineration, Landfills, Laboratory tests, On-site tests, Odor, Rodents.

Identifiers: Land farming, Composting, Flies.

Experiments have been conducted to determine the utility of mixing refuse with the top layer of soil as an additional method of soild waste disposal. Such a process is theoretically a combination of incineration and landfilling, the two currently popular methods of waste disposal. Raw refuse and partially stabilized refuse was applied to test plots 3 times a year (April 1, July 1, and October 1) at rates of 50,100, 200, 300, and 400, tons per acre. The refuse was mixed with the soil using conventional farming equipment. The results of a year's operation indicate: (1) no rodent or fly problems were evident; (2) the refuse decomposed well in the soil; (3) no biological problems were apparent; (4) the land could accept refuse at rates up to 400 tons/acre; and, (5) the major problems appeared to be development of proper equipment to economically apply refuse to soil. Laboratory tests were conducted in parallel to determine the rates of disappearance of putrescible matter and paper ap-

plied at different loading rates. The laboratory tests confirmed field observations concerning fly and rodent problems, odors and rates of disappearance. A preliminary estimate of the costs for this process are that costs might run between \$2.50 and \$5.63 per ton. These are preliminary experiments, there remains much work to be done on this concept and many answers to be obtained before this process can be recommended with confidence. (Goessling-Texas)
W72-02671

THE MISSOURI APPROACH TO ANIMAL WASTE MANAGEMENT, Missouri Univ., Columbia. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05C. W72-02837

AN ASSESSMENT OF SOME PUBLIC HEALTH PROBLEMS RESULTING FROM FEEDING POULTRY LITTER TO ANIMALS. MICROBIOLOGICAL AND CHEMICAL PARAMETERS,

MICROBIOLOGICAL AND CHEMICAL PARAMETERS,
Food and Drug Administration, Cincinnati, Ohio.
Div. of Microbiology.
James W. Messer, Joseph Lovett, Gopala K.
Murthy, Albert J. Wehby, and Mary L. Schafer.
Poultry Science, Vol 50, No 3, p 874-881, May
1971. 3 tab, 14 ref.

Descriptors: \*Farm wastes, \*Poultry, \*Disposal, \*Feeds, \*Public health, Cattle, Hogs, Sheep, Pesticide residues, Microbiology, Health, Diseases, Salmonellae, Sewage, Bacteria, Arsenic compounds. Identifiers: Food and Drug Administration, Medicinals, Ultraviolet-light-activated substances.

Feeding studies on the utilization of poultry litter as a feed additive for ruminants have demonstrated satisfactory animal nutrition, thus, opening many questions of public health significance. This study examined the heat resistance of salmonellae and Arizona pathogens; whether heat treatment of poultry litter would provide an effective barrier against disease transmission; and determined the levels of some medicinals, pesticides, and ultraviolet light activated compounds in poultry litter. Results showed that a heat process for the elimination of salmonellae and Arizona sp. may be feasible, since they are not highly resistant to heat. E. Coli being less resistant to moint heat than salmonellae, were eliminated as an indicator of the efficiency of the heating process. With the exception of arsenic, the concentration of pesticides and medicinals present in the litters assayed in this study were low. On the basis of the highest observed values in litter, beef cattle and dairy cattle fed 30% of their diet as litter would receive approximately 46.0 mg of arsenic, 19.0 milligrams of uric acid, 16.0 milligrams of nitrofurazone, 15.0 milli-grams of furazolidone, and 1.4 milligrams of ul-traviolet-activatable substances per day. The possi-bility of higher levels and the unknown effect of continuous exposure to low levels suggests the present ban on the interstate shipment of poultry litter for animal feed is warranted. (Schmitt-Iowa State) W72-02838

POULTRY WASTE HANDLING SYSTEMS, Cornell Univ., Ithaca, N. Y. Dept. of Poultry Science. For primary bibliographic entry see Field 05D. W72-02842

BROILER LITTER ON WELSH COAL TIPS, Colin White. Agriculture. Vol 77, No 2, February 1970, p 49-51.

Descriptors: \*Poultry, Farm wastes, \*Coal mine wastes, \*Land reclamation, Perennial ryegrass, Vegetation establishment, Germination. Identifiers: \*Broiler litter, Field trials, South Wales.

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ANIMAL Illinois U Quality. Proceeding

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#### WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

## Water Treatment and Quality Alteration—Group 5F

In South Wales large areas of land occur as gigantic In South waies large areas of land occur as gigantic coal spoil tips. Interested local authorities are increasingly concerned that disused tips should be landscaped. Presently, however, up to five years may elapse before this land is considered suitable for return to agricultural use. The National poultry laying flock produces 2,000,000 tons of fresh manure per annum. This poultry manure has values that may fit it well for use on derelick land. Tests and trials were arranged to see if poultry manure could ameliorate the harsh conditions presented in trying to establish grass on coal tips. Hen battery slurry was first considered and used in the first germination test. Italian ryegrass seed was mixed with the slurry and applied to tip material. Germination was only about 50%. Next the grass seed was placed on the tip material and then covered by broiler litter. No loss in germination was found with this second method. Field tests were then made using this technique. The results were satisfactory. Further trials and observations are being conducted on tips and restored opencast sites. (Parker-Iowa State) W72-02843

ANIMAL AND HUMAN METABOLIC WASTES. Illinois Univ., Urbana. Council on Environmental Quality.

Proceedings of First Allerton Conference, December, 1970, Special publication no. 21, Col-lege of Agriculture, Illinois University at Urbana-Champaign, April, 1971, p 23-25. 2 tab.

Descriptors: \*Farm wastes, \*Water pollution, \*Biochemical oxygen demand, \*Sludge disposal, Municipal wastes, Anaerobic digestion, Oxidation, Fertilizers.

Pollution abatement. Population Identifiers: equivalents.

Livestock needed to produce America's meat supply also produce 2 billion tons of manure per Undiluted livestock wastes are 100 time more concentrated than municipal sewage. Pollutants include plant nutrients, oxygen-demanding components, infectious agents, color, and odor.
Aerobic bacteria thrive at Dissolved Oxygen levels
down to .5 ppm, but fish need about 4 ppm. Typical BOD livestock population equivalents include dairy cow — 12, 200 pound hog — 2.5, and laying hens — 0.10. The greatest potential for stream pollution is feedlot runoff. Methods of abatement include diverting rainwater around lots, collecting runoff in detention ponds, and putting roofs over lots. Most odor nuisance can be avoided by incinerating, Most odor nuisance can be avoided by incinerating, composting, refeeding proteinaceouslooids, or anaerobically digesting. Farmland can be used to dispose of digested sludge of municipal waste treatment plants. Typical fertilizer contents of total sludge (water and solids) are 5 per cent nitrogen, 3 per cent phosphorus, and .5 per cent potassium. Land, not watercourses, should be the receptor of livestock and municipal waste residues (Schmitts, and municipal waste residues). livestock and municipal waste residues. (Schmitt-Iowa State) W72-02848

EFFECT OF METHOD OF MANURE HAN-DLING ON CROP YIELDS, NUTRIENT RECOVERY AND RUNOFF LOSSES,

Wisconsin Univ., Madison. Dept. of Agricultural Engineering; and Wisconsin Univ., Madison. Dept. of Soils.

R. R. Hensler, R. J. Olsen, S. A. Witzel, O. J. Attoe,

and W. H. Paulson. Transactions of the American Society of Agricultural Engineers, Vol 13, No 6, p 726-731, November-December 1970. 10 tab, 26 ref. OWRR-14-01-0001-858.

Descriptors: \*Farm wastes, \*Crop production, \*Application methods, Runoff, Nutrients, Greenes, Waste disposal, Chemical analysis, Fertility, Soil chemical properties.

Identifiers: \*Nutrient recovery, Anaerobic liquid manure, Aerobic liquid manure

A study was made of the effect of type of manure, method of handling, amount of bedding, drying treatment, and rate of application on the fertilizing value of cattle manure for corn and hay and on ru-noff losses. Dairy and beef cattle manure was applied as fresh, fermented, aerobic liquid and anaerobic liquid, both in greenhouse conditions and in actual field tests. Tests were run to determine nutrient loss before application and nutrient recovery by plants and runoff losses after application. Results showed increased corn dry matter in all cases of manure application with poorer results shown by the aerobic liquid than the other three. Allowing manure to dry for one week before incorporation usually gave lower yields and lower recovery values for N, P, and K. Total dry-matter yields of corn were not greatly affected by increasing amounts of bedding up to 8 percent, but at the 16 percent rate, yields were usually much lower. (Parker-lowa State) W72-02852

OCEAN SLUDGE DISPOSAL BY BARGES, Tetra Tech, Inc., Pasadena, Calif. For primary bibliographic entry see Field 05B. W72-02873

WASTE HEAT DISPOSAL IN THE GREAT LAKES. Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 02H.
W72-02882

#### 5F. Water Treatment and **Quality Alteration**

**OPTIMIZATION OF POWER PLANT COOLING** WATER DISCHARGE IN STREAMS, Kansas State Univ., Manhattan. Dept. of Chemical

Engineering. bibliographic entry see Field 06A. W72-02356

SMALL QUANTITY FIELD DISINFECTION. Illinois Univ., Urbana, Dept. of Sanitary Engineer-

J. T. O'Connor, and S. K. Kapoor.

Journal of the American Water Works Association, Vol 62, No. 2, February 1970, p 80-84, 5 tab, 11 ref \*Water purification, Chlorine, Military aspects, Hunting, Camping, Laboratory tests, On site data collection, Odor, Taste, Color, Evaluation, \*Water

Identifiers: \*Halazone tablets, \*Globaline tablets,

There are many occasions when water disinfection must be practiced on a small scale and under adverse conditions. There are currently two tablets being used for water disinfection in the United States, the halazone tablet and the globaline tablet. An exhaustive study of the properties of both halazone and globaline has been conducted. The results of this study are: (1) globaline would be more effective if an alkaline buffer (pH of 8) were used in the tablet; (2) further studies are desirable to find a better agent to facilitate dissolution of the globaline tablet; (3) color, taste and odor problems associated with globaline are moderate in the laboratory but Marines in Viet Nam mask the taste with soft drink mixes; (4) if not done properly, the addition of soft drink mixes, reduces the effectiveness of the tablet; (5) halazone is, at present, insuitable for military use due to the small amount of available disinfection; (6) the use of an acidic buffer (pH of 6) might resolve this problem; (7) the practice of packaging 50 tablets in a single bottle might be improved by smaller lots per bottle or the use of powder pillows. (Goessling-Texas) W72-02379 JOINT DISCUSSION-COMBINED OPERATIONS OF WATER AND WASTEWATER UTILITIES, Richmond. Virginia State Dept of Public Utilities, For primary bibliographic entry see Field 05D.

OPINIONS RELATING TO FLUORIDATION:

DEVELOPMENT OF MEASURES, Georgia Inst. of Tech., Atlantic. School of Psychology. C. M. York.

Water Resources Bulletin, Vol 7, No 5, October 1971, p 920-924. 5 tab, 7 ref.

Descriptors: \*Fluoridation, \*Attitudes, \*Measurement, Decision making, Planning, Water supply, Methodology, Participation. Identifiers: \*Public opinion, \*Public participation, Elected officials, Technical specialists.

Elected officials, technical specialists and the public are talking more about 'citizen input' into the decision process, and how the people view a given issue or kind of public service. However, problem definition and valid instruments are needed before we can meaningfully predict or un-derstand public attitude relating to a particular issue or concept. The fluoridation of community water supplies was chosen for the present methodological demonstration. This issue achieves a high level of controversy among many public seg-ments. By 1950, there was widespread endorsement for a national program relating to controlled water fluoridation. Yet, public acceptance of this particular technological advance has not been very high. (Strachan-Chicago) W72-02463

MECHANISM OF THE CARIES-INHIBITING EFFECT OF FLUORIDE, (IN DANISH),

Aarhus Tandlaegehojskole (Denmark). Frithjof Von Der Fehr. Tidsskr Nor Laegeforen. 90 (3): 293-300, 326. Ilus. 1970. English summary.

Identifiers: Caries, Fluoride, Human, Inhibiting, Mechanism

Dental caries is a result of alterations in the local environment. Attention therefore should be directed towards the fluoride concentrations in the outer enamel and in the dental plaque. In young individuals, caries reductions of 50-60% result from lifelong exposure to fluoridated drinking water. In terms of enamel fluoride, such exposure leads to deposition of about 1000 ppm in the outer enamel surface and an increase of 300-400 ppm as compared to the teeth from a low fluoride area. Similarity, an increase in total plaque fluoride is demonstrated following the use of fluoridated drinking water. While an adequate supply of fluoride during tooth development may contribute to improved morphology and ultrastructure of the teeth, these factors play a minor role in the caries reduction observed. The lowered solubility of fluoridated enamel was long considered the main factor responsible for caries inhibition. Several observations indicate a lowered solubility rate, a smaller activity product at equilibrium, increased precipitation rate in the metastable region and preference for hydroxyapatite formation at the ex-posure of more acid calcium phosphates. Precise information about the importance of the solubility reducing effect of fluoridation is still needed. Antibacterial and anti-enzymatic effect of fluoride cannot be dismissed when considering the amount of fluoride present in the plaque. The activity of free fluoride ions in this milieu is still unknown. By reduction of the absorption of organic material, fluoridation of enamel may interfere with plaque formation.--Copyright 1971, Biological Abstracts,

## Group 5F—Water Treatment and Quality Alteration

PREVENTION OF CARIES IN CHILDREN BY MEANS OF LOCAL OR GENERAL FLUORIDA-TION, (IN ITALIAN), Istituto Superiore di Odontoiat. G. Eastman, Rome

(Italy). V. Baldinetti.

Ann Stomatol. 19 (5): 407-414. 1970. English sum-

mary. Identifiers: Caries, Children, Fluoridation, Local, Prevention, Topical

The efficiency of fluoride in caries prophylaxis is emphasized and several methods for fluoride administration in different countries and results obtained are presented. First censures of indis-criminate water fluoridation are discussed; topical fluoride application and enamel condition checkup, during periodic dental examinations are recom-mended.--Copyright 1971, Biological Ab-W72-02518

VIRUS IN WATER: I. A PRELIMINARY STUDY ON A FLOW-THROUGH GAUZE SAMPLER FOR RECOVERING VIRUS FROM WATERS, Environmental Protection Agency, Narragansett,

R. I. Water Hygiene Lab. O. C. Liu, D. A. Brashear, H. R. Seraichekas, J. A.

Barnick, and T. G. Metcalf. Appl Microbiol. 21 (3): 405-410. 1971.

Identifiers: Assessment, Flow, Gauze, Human, Pollutant, Recovering, Sampler, Viral, Virus.

A preliminary study was carried out on evaluating a flow-through gauze sampler for its efficiency in recovering virus from both fresh and seawater. An attenuated type I poliovirus was used as the working model. When tap water was sampled, the amounts of virus adsorbed by the gauze pads were very small, about 2% of the total number of virus particles flowing through the device. The virus adsorption and recovery increased to 15 to 19% when seawater was sampled. Addition of NaCl to tap water produced a much better effect on virus adsorption and recovery by this device, i.e., 47% of the total virus particles in each sample. The best viral elution from the pads was obtained by using buffer solution of pH 8.0 to 9.0 containing a small amount of animal serum. Repeated elutions from the pads were necessary to recover the most virus although the 1st eluate contained approximately 50% of the adsorbed virus. Further development of this device appears warranted, because of the simplicity of the procedure, its capability of sampling large volume of water, economical sample collec-tion, and the feasibility of obtaining a rough quantitative assessment of viral pollutants in water examined .-- Copyright 1971, Biological Abstracts, W72-02529

THE COMPOSITION OF TEA INFUSIONS EX-AMINED IN RELATION TO THE ASSOCIA-TION BETWEEN MORTALITY AND WATER HARDNESS.

Institute of Cancer Research, Sutton (England). W. Anderson, J. G. Hollins, and Pamela S. Bond. J Hyg. 69 (1): 1-15. Illus. 1971.

Identifiers: Association, Calcium, Cardio, Composition, Disease, Examined, \*Hardness, Human, Infusions, Mortality, Nutrition, Relation, Tea,

Recent epidemiological studies showed that deathrates from certain chronic diseases are higher in areas with soft than in areas with hard drinkingwater. In the striking negative correlation found in the county boroughs of England and Wales between cardiovascular mortality and water hardness, the important underlying factor is apparently
the water Ca. The dietary significance of Ca
present in drinking-water was investigated; a quantitative account of the composition of tea infusions
prepared with waters containing different amounts
of Ca is presented. A substantial part of water Ca is taken up by the tea leaf during the preparation of infusions. The analysis of the infusions covers a wide range of individual components, including trace metals and polyphenolic substances. It ap-pears that the principal change caused in infusion composition by the presence of Ca in the water is a substantial reduction in the relatively high oxalate content. The question is raised whether there may be some connection between the 'water factor' in cardiovascular disease and the absorption of oxa-lates from foods.--Copyright 1971, Biological Ab-W72-02627

DRINKING WATER IN MADAGASCAR: STUDY OF 12,569 BACTERIOLOGICAL ANALYSES,

Sante DES Armees, Tananarive Service de (Madagascar).

Pierre Coulanges, Andre Mayoux, and Edward R. Brygoo. Arch Inst Pasteur Madagascar. 39 (1): 229-266.

1970.

Identifiers: Analyses, Bacteriological, Clostridium-Perfringens, Drinking, Escherichia-Coli, Klebsiella, Madagascar, \*Potability.

After presenting the analytical techniques and the potability norms used, the situation of the water supply in Tananarive, porvincial capitals, and 23 other towns on the island, is discussed. For each town, the following information is given: population, nature of the water supply, method of treatment, rhythm of sampling, results of analyses. The water, whether potable or not, is classed as much as possible according to its origin: 'raw' water, water coming from the treatment plant, water from distribution pipes and taps, water from terminal fountains or cisterns, and water from reservoirs. Among the organisms found were: Escherichia coli, Kleb siella, and Clostridium perfringens. The great qualitative and quantitative deficiency of water surquantitative and quantitative deficiency of water sur-veillance in Madagascar, is brought out; in Tananarive, 6977 examples of potable water were found in 7392 samples (94.3%), the best results. The urgent need for regulations valid for the entire island, concerning methods of drinking water surveillance, is emphasized.--Copyright 1971, Biological Abstracts, Inc. W72-02630

THE IMPORTANCE OF FLOODS IN SPREAD-ING SCHISTOSOMIASIS MANSONI, (IN POR-TUGUESE), Escola Paulista de Medicine, Sao Paulo (Brazil).

Alberto Da Silva Ramos, Jose De Toledo, and **Euclides Froes** 

Rev Saude Pub. 4 (1): 1-5. 1970. English summary. Identifiers: Brazil, Floods, Mansoni, Planorbid, \*Schistosomiasis, Spreading, Vector.

The interference of floods in the planorbid life cycle is discussed. One of the consequences is the exacerbation of schistosomiasis in the old foci and the appearance of new ones. The occurrence was verified in the county of 'Sao Jose dos Campos,' State of Sao Paulo, Brazil, where the parasitosis increased in 2 old foci after the overflowing of the Paraiba river and its tributaries.—Copyright 1971, Biological Abstracts, Inc. W72-02640

COST OF DOMESTIC WELLS AND WATER TREATMENT IN ILLINOIS,

Illinois State Water Survey, Urbana For primary bibliographic entry see Field 06C. W72-02753

5G. Water Quality Control

IDAHO (ANALYSIS OF WATER POLLUTION LAW AND COMPARISON WITH PRESENT AND PROPOSED TENNESSEE LAW), For primary bibliographic entry see Field 06E. W72-02254

GERBING V. ITT RAYONIER (QUI TAM ACTION UNDER RIVERS AND HARBORS ACT). For primary bibliographic entry see Field 06E. W72-02306

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HYDROLOGY OF HORSESHOE LAKE, AR-KANSAS.

Geological Survey, Little Rock, Ark. For primary bibliographic entry see Field 04A. W72-02321

ENVIRONMENTAL IMPACT STATEMENT

(DRAFT). Geological Survey, Washington, D.C. For primary bibliographic entry see Field 08A. W72-02328

A STUDY OF PUBLIC ATTITUDES AND MUL-TIPLE OBJECTIVE DECISION CRITERIA FOR WATER POLLUTION CONTROL PROJECTS, Georgia Inst. of Tech., Atlanta. School of Industrial

and Systems Engineering.
For primary bibliographic entry see Field 06B.
W72-02360

RECOVERY OF FLOATING OIL: ROTATING DISK TYPE SKIMMER. Susquehanna Corp., Costa Mesa, Calif. Atlantic Research Systems Div.

Copy available from GPO Sup Doc for \$1.25; microfiche from NTIS as PB-EP2.10; \$0.95. 15080 FWN 07/71, PB-205 208. Water Pollution Control Research Series, July 1970, 134 p. 75 fig, 2 tab, 5 ref. EPA Program 15080 FWN, Contract 14-12.883

Descriptors: \*Oily water, \*Skimming, Oil-water interfaces, Water waves, Emulsions, Submergence, Frothing, Viscosity, Aluminum, Water quality control, Water pollution control, \*Oil wastes.
Identifiers: \*Rotating disc oil skimmer, \*Oil slicks, Rotational speed, Entrainment,

Laboratory tests indicated the feasibility of recovering 50,000 gal. of oil per hour using a series of powered discs approximately 7 ft. in diameter and 12 ft. long. Testing included various oils ranging from light diesel oil to Bunker 'C' grade oil. Initial tests were performed in still water to establish baseline performance data and understanding of scaling effects. Oil spread as thinly as 1.5 mm in thickness was amenable to collection, but recovery efficiency greatly improved with increased thickness. Herding of the oil with booms, as well as current, whether natural or caused by towing the disc unit through the oil, were shown to increase the oil thickness. Oil starvation, in the form of insufficient oil contacting the disc was shown to be a significant problem, but recovered oil still contained only around 2% moisture, eliminating the need for a separator. Wave action was shown to actually enhance pick-up as long as the waves were not breaking and entraining the oil in the water. (Lowry-Texas) W72-02367

BASS ANGLERS SPORTSMAN'S SOCIETY OF AMERICA V. SCHOLZE TANNERY, INC. (PRIVATE RIGHT TO ENFORCEMENT OF THE RIVERS AND HARBORS ACT) For primary bibliographic entry see Field 06E. W72-02381

PAPER, National Industrial Pollution Control Council, Washington, D. C., Paper Sub-Council. For primary bibliographic entry see Field 05D. W72-02382

CAPE MAY COUNTY CHAPTER, INC., IZAAC WALTON LEAGUE OF AMERICA V MACCHIA (CONSERVATION GROUP'S STANDING TO

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

SUE UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT).
For primary bibliographic entry see Field 06E.
W72-02389

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FINANCING OF MUNICIPAL FACILITIES TREATING INDUSTRIAL WASTES, Environmental Protection Agency, Washington, D.C. Office of Water Programs.

R. C. Palange, and E. D. Dildine.

Preprint, presented at 44th Annual Conference of the Water Pollution Control Federation, San Fran-cisco, October 6, 1971. Session 16, No 1.14 p.

Descriptors: \*Waste water treatment, Municipal wastes, Industrial wastes, Federal budgets, \*Cost sharing, \*Cost allocation, State jurisdiction, Regional analysis, Long term planning, \*Financing, \*Treatment facilities, Operating costs.

The voices of science and the voices of the people are telling us that society must find new ways of doing business—that the environmental ethic of the doing business—that the environmental ethic of the past, however valid it was in the past, is no good for the Age of Aquarius. The cost of maintaining the environment must be included in the cost of doing business. The Federal Regulations of July 2, 1970, through the planning requirement, will avoid inefficient use of public funds by requiring a coordinated attack on water pollution by all communities along a waterway before public money may be spent on municipal treatment facilities. Municipalities, which in the past have offered free sewage treatment to local industries, no longer will be able to do this. The new regulation insists that municipalities recover industry's fair share of the total initial costs as well as a pro-rate share of operational costs to as well as a pro-rata share of operational costs to qualify for federal assistance. The environmental crisis poses a revolutionary challenge and an unparalleled opportunity for us all. Government and industry must respond to the challenge and grasp the opportunity. (Goessling-Texas) W72-02399

EARTHQUAKE DAMAGE TO THE LOS AN-GELES SEWER SYSTEM, Los Angeles Dept. of Public Works, Calif. P. V. King, and J. M. Betz.

Preprint, presented at 44th Annual Conference of the Water Pollution Control Federation, Session 23, No 5, October 7, 1971. 18 p, 4 fig, 1 tab.

Descriptors: \*Earthquake disaster, \*California, \*Sewer, \*Clay pipe, Design criteria, Water pollution control.

tion control.

Identifiers: \*Los Angeles, \*San Fernando Valley (Calif), Sewer rodding, Television logging.

The rather unique problem of determining damage The rather unique problem of decimaling distances to sanitary sewers was presented to Los Angeles on February 9, 1971, when an earthquake of 6.6 on the Richter Scale struck the area. Damage survey procedures followed three steps: (1) manholes were inspected to establish the perimeter of the major damage; (2) a program of manual and automatic rodding of lines was started to clear stopped lines and to make a better determination of damage; (3) television cameras were used to obtain detailed damage information. Type of damage included broken pipe, broken joints, pulled joints, and grade changes. 100 manholes also warranted repair. Several variable factors were associated with damage but information on only four was available to permit reasonably valid conclusions to be drawn. Those variables were, size of pipe, type of joint, encasement of pipe, and location with respect to fault zone. Size and type of pipe appeared insignificant but encasement did not. Location was very important. Damage survey procedures were effective, but the television program needed a few changes. Several future design considerations were mentioned, but it was felt that it would be very difficult to justify extra expense to reduce the risk of earthquake damage becuase of the uncertainties of earthquake frequencies. (Biggs-Texas) W72-02407

UTILIZATION OF ALGAE BY DAPHINIA AS INFLUENCED BY CELL SENESCENCE AND UV IRRADIATION, Maryland Univ., College park. Dept. of Zoology. R. G. Stross, J. C. Jones, F. M. Unger, and J. M.

Proceedings, Industrial Waste Conference, 20th, May-4, 5, and 6, 1965. p 706-714, 4 fig, 5 tab, 17

Descriptors: Water quality, \*Algal control, Eutrophication, Daphnia, Chlamydomonas, Laboratory tests, Particle size, Population, Growth rates, Water pollution control.

Identifiers: Algal senescence, Growth inhibitions.

Suspensions of algae, bacteria and detritus are ingested by many groups of animals. DAPHINIA are equipped with thoracic limbs which collect particles from dilute suspensions. The number of particles ingested depends on size, density and other factors such as nutritional deficiencies or indegestifactors such as nutritional deficiencies or indegestibility. A study has been completed in which the utilization of CHLAMYDOMONAS reinhardi (Dangeard I.U. strains No. 89 and 90) by DAPHNIA pulex De Geer was measured which allowed an evaluation of the effect of senescent and UV irradiated algae on the intrinsic rates of increase of DAPHNIA populations. The results of these tests were: (1) the intake of algal cells by DAPHNIA decreased with the age of the algal culrure; (2) inhibition was produced by the cells and the particle-free medium of the culture; (3) the feeding of senescent cells reduced the intrinsic rate of population increase to nearly one third that of feeding of senescent cells reduced the intrinsic rate of population increase to nearly one third that of control populations; (4) birth rate of DAPHNIA was more strongly influenced than death rate; (5) irradiation of log-phase cells with far UV stimulates the effect of cell senescence on growth of the DAPHNIA; (6) lipid peroxides in the cells increased with the dose of UV but most of the growth inhibition resulted from the minimum dose; and, (7) a hypothetical population was constructed to (7) a hypothetical population was constructed to show the influence of algal senescence on density and permissable washout rate of DAPHNIA population in equilibrium with its food supply. (Goessling-Texas) W72-02417

COMPOSTING BY ARTIFICIAL AERATION, Portland-Zementwerke, Heidelburg (West Ger-E. Spahn.

Compost Science, Vol 11, No 3, May-June 1970. p 22-23.

Descriptors: \*Solid wastes, \*Municipal wastes, Biodegradation, Automatic control, Homogeneity, Air circulation, Moisture content, Temperature, Storage, On-site tests, \*Aeration.
Identifiers: \*Compost process, Rasping machines,

Waste utilization.

Municipal compost systems had their origin in the disadvantages of the classic method, windrow com-posting which depended on the weather and an extended period to produce a useful product. These innovations alleviated some of the problems of composting but none satisfy all of the requirements for a modern, automated system necessary to make a salable product without high costs, in land, storage space or wages. A process has been developed at the Blaubeuren compost plant which developed at the Blaubeuren compost plant which does satisfy all of the requirements. Incoming refuse is reduced in size by a rasping machine, mixed with water or sewage sludge into a homogenous mass and deposited in aeration cham-bers. Each aeration chamber has its own oxygen probes to signal when oxygen levels reach 12%. Air is pulled through the chamber by a suction blower which can service several chambers on a time sharwhich can service several chambers on a time sharing basis. Temperature and moisture are also monitored. The finished product, produced in about
four weeks, has no ammonia but plenty of nitrate.
This process has been in successful operation for
two years using improvished equipment. The
results have been good enough for the installation
of fully mechanized equipment. For the first time, it
has been possible to produce independent of has been possible to produce, independent of

weather, by an automated process, a compost which is fully ripe within four weeks and free of am-monia. (Goessling-Texas) W72-02423

THE UPTAKE OF P32 AND CA45 BY PURE AND MIXED CULTURES OF BACTERIA, Howard Univ., Washington, D. C. For primary bibliographic entry see Field 05A. W72-02424

UNITED STATES V. UNITED STATES STEEL CO. (PROSECUTION UNDER THE REFUSE ACT). For primary bibliographic entry see Field 06E. W72-02428

BIODEGRADABILITY AND TREATABILITY
OF ALKYLPHENOL ETHOXYLATES-A CLASS
OF NONIONIC SURFACTANTS,
Rohm and Haas Co., Spring House, Pa.
E. S. Lashen, and K. A. Booman.
Proceedings, Industrial Waste Conference, 22nd,
May 2, 3, and 4, 1967. p 211-228, 13 fig, 6 tab, 21

Descriptors: \*Waste water treatment, \*Biodegradation, On site tests, Laboratory tests, Acclimatization, Activated sludge, Analytical techniques, Eutrophication, Self purifications, Streams, Detergents, \*Extended aeration, \*Surfac-

Identifiers: \*Nonionic surfactant, Alkylphenol ethoxylates.

Several studies have been made by this company to determine the biodegradability of OPE10 (p, t-octylphenoxynonaethoxyethanol), a nonionic surfac-tant in common use in detergents. The results of these studies clearly demonstrate the biodegrada-bility and treatability of OPE10. In field tests using a package plant extended aeration process degradation was 90% or better, as indicated by chemical analysis and loss of surfactant properties. The degradation of OPE10 in the laboratory in activated sludge tests was found to agree with that ob-served in the field study. The time to achieve accli-mation to OPE10 in the laboratory varies with the mation to OPE-10 in the aboratory varies with the sludge used and with the test method employed. Acclimation of the river microflora to OPE-10 oc-curs naturally. Samples of the Schuylkill, Ohio and Delaware Rivers were tested. Where this type of surfactant had not been used, the rate of degradation was slow. Repeated exposure to OPE10 led to an increasing rate of degradation which compared with those of waters exposed to large doses of these surfactants. The acclimation period is important in that tests which provide for this period more accurately determine the degradability of wastes than those that do not account for acclimation. (Goess-line Taxes) ling-Texas) W72-02431

A SYSTEM OF RIGHTS FOR USE IN THE MANAGEMENT OF WATER QUALITY, Washington Univ., Seattle. Dept. of Civil Engineer-

ing. B. W. Mar.

OWRR Research report, April, 1971. 24 p, 3 fig, 1 tab, 14 ref, 1 append. OWRR B-023-WASH (4).

Descriptors: \*Water quality control, \*Water management (Applied), \*Water rights, \*Market value, Water quality, Water treatment, Economic efficiency, Utilities.
Identifiers: Pollution rights.

Water quality management based on water quality Water quality management based on water quality standards and required levels of waste treatment have serious information and administrative problems. Consequently, an alternative management system based on marketable pollution rights is proposed and analyzed. The rights are defined in terms of changes in water quality, and thus would provide the flexibility to respond to, say, river flow

#### Group 5G-Water Quality Control

differences. Furthermore, such a system of rights would (1) simplify the problems of entry of new dischargers in a region, (2) incorporate the economic efficiency of the effluent charge system and the regional management approach, and (3) provide a mechanism for government or the private sector to adjust the quality of water without creat-ing serious economic penalties on other parties that discharge waste or require high water quality. A study of the Willamette River region indicates study of the winamette River region indicates these rights may be highly valued. Thus, an individual desiring improved water quality would have difficulty in financing the acquisition of sufficient rights to provide relief from degraded water quality. A resort to institutional arrangements might overcome this difficulty. The type of rights proposed provides a set of management tools that can be used in lakes, rivers, or estuaries. (Settle-W72-02442

THE WAR ON POLLUTION, ECONOMIC AND FINANCIAL IMPACTS, Virginia Univ., Charlottesville. Graduate School of Business Administration.
W. W. Sihler, and C. O. Meiburg.
Business Horizons, p 19-30, August, 1971. 3 tab, 7

Descriptors: \*Economic impact, \*Investment, \*Pollution abatement, Capital costs, Gross national product, Financial analysis.
Identifiers: Money market, Pollution charges.

Viewed over the long run, expenditures for environmental control may be the most productive for society, but they don't fit into the traditional concept of investment. They do not increase our capacity to produce consumer goods in the future. Using a \$7-8 billion estimate of annual capital ex-Using a \$7-8 billion estimate of annual capital expenditures for pollution control, it was estimated that GNP may fall from its present 3.5-4% yearly increase to a 3.0-3.5% increase per year. These effects on GNP could be reduced if funds for pollution control were shifted from other investment areas such as defense. Alternatives for financing pollution control include (1) direct federal grants, (2) authority financing by direct funding or federal loan guarantees and (3) tax policy changes including tax credits, pollution charges, and retirement of ing tax credits, pollution charges, and retirement of the federal debt. It was suggested that there would be little impact on the money market if the federal government merely set standards. Corporations would just reduce projected capital investment by the amount of pollution control investment required to meet federal standards. If the federal government attempted to finance some of the requirements, there would be intense pressure on the money supply. This could be reduced by shift-ing government spending priorities or by increased taxes. (Wade-Wisconsin) taxes. (Wade W72-02445

NEXT BIG INDUSTRY: ENVIRONMENTAL IM-PROVEMENT, Dartmouth Coll. Hanover, N.H. Amos Tuck School

of Business Administration. For primary bibliographic entry see Field 06D. W72-02446

ON THE ECONOMIC IMPACT OF LARGE DIVERSIONS OF SNAKE RIVER WATERS, Washington State Univ., Pullman. Dept. of Mathematics; and Washington State Univ., Pullman, Washington. Water Research Center. For primary bibliographic entry see Field 06A. W72-02448

ECONOMIC AND ENVIRONMENTAL IM-PACTS OF THE PROPOSED SOUTH CAROLINA TAX CREDIT FOR INDUSTRIAL POLLUTION CONTROL FACILITIES, Clemson Univ., S.C. Dept. of Agricultural Economics. J. M. Stepp.

Paper presented at: Council on Water Policies, Water Resources Research Institute, February 15, 1971, Clemson University, Clemson, South Carolina. 22 p., 1 tab. OWRR A-017-SC (4).

Descriptors: \*South Carolina, \*Pollution abatement, \*Economic impact, \*Water Quality Act, \*Total costs, \*Annual costs, Government finance, Waste water treatment, Treatment facilities, Industrial plants.

Identifiers: \*Industrial pollution control, \*Tax

Effects of a proposed tax credit are evaluated in terms of the cost to the state, propensity for pollution abatement and influence upon industrial loca-tion. By setting a five-year time limit for the completion of tax credit facilities, this law would substantially expedite pollution abatement to offi-cially acceptable levels. The cost to the state in terms of reduced corporation income tax revenues is tentatively estimated at a maximum of \$18 mil-lion a year. Factors affecting this estimate are discussed in detail. Manufacturing plants with seridiscussed in detail. Manufacturing plants with serious and expensive pollution control problems will be attracted to locate in South Carolina at the expense of firms with fewer problems. Fewer location sites, degraded environmental quality and increased taxes or decreased state services necessary to pay the tax credit subsidy discourage location of the control of forts. the latter firms. Industrial pollution control efforts of other states are discussed and compared and alternative courses of action to the tax credit law enumerated. (Haugh-Wisconsin) W72-02453

FIRST REPORT OF THE LAKE MICHIGAN, AND ADJOINING LAND STUDY COMMISSION OF THE STATE OF ILLINOIS.

State of Illinois, Lake Michigan and Adjoining Land Study Commission.

Report to the Governor and the 77th General Assembly, Vol 1, October 1971. 38 p, 1 fig, 1 append.

Descriptors: \*Environment, Water quality, Water pollution, \*Water pollution control, \*Water pollution sources, \*Land use, Public health, Eutrophication, Aesthetics, Sewage, Attitudes, \*Illinois,

\*Lake Michigan. Identifiers: Lake Michigan and Adjoining Land Study Commission, Attitude of de minimis

The Lake Michigan and Adjoining Land Study Commission studied environmental problems of Lake Michigan and its adjoining land within Il-Lake Michigan and its adjoining land within Il-linois. Two focus points were identified: (1) water quality in Lake Michigan, and (2) land use along Lake Michigan. The following conclusions were made about water quality in Lake Michigan. (1) Health-related water quality parameters such as bacteria levels, radioactivity, and disease causing viruses have worsened. (2) Due to the persistent high rates of phosphate and ammonia nitrogen in the lake the process of eutrophication has acthe lake, the process of eutrophication has accelerated. (3) Southern Lake Michigan has become and remains inhospitable to aquatic life. (4) The aesthetic quality of the lake has not improved. Industrial and domestic sewage, land runger of air adultion followers from the contractions of the lake has not improved. proved. Industrial and comestic sewage, land runoff, air pollution fallout, wastes from watercraft, and harbor dredging deposits contribute to the pollution of the lake. Two reasons for the continuing pollution of the lake are indicated: (1) an attitude of de minimis which views the problem of pollution in terms of separate sources, each one being deemed inconsequential in relation to the overall pollution of the lake, and (2) lax pollution control standards. The Commission recommends the adoption of a bill or rights for Lake Michigan in the form of a policy statute which sets forth the State's pri-orities for the lake and lakefront and designates orities for the lake and lakefront and designates how these goals should be implemented. Further recommendations for the study of viral contamination, restrictive controls on thermal pollution, improvement of water quality sampling, identification of polluters, and the renewal of the Lake Michigan and Adjoining Land Study Commission, are suggested. (See also W72-02460) (Strachan-Chicago) W72-02459

APPENDIX: PROPOSED LAKE MICHIGAN AND ADJOINING LAND RESOURCE MANAGE-MENT AND PRESERVATION ACT.
State of Illinois, Lake Michigan and Adjoining Land Study Commission.

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In: First Report of the Lake Michigan, and Adjoining Land Study Commission of the State of Illinois, Report to the Governor and the 77th General Assembly, Vol 1, October 1971, p 28-38.

Descriptors: \*Planning, \*Environment, \*Ecology, Water quality, Water pollution control, \*Land use, Public health, Management, Drilling, Mining, Landfills, Wastes, \*Illinois, \*Lake Michigan. Identifiers: \*Policy making, Lake Michigan and Adjoining Land Study Commission, Total manage-

This bill is proposed by the State of Illinois Lake Michigan and Adjoining Land Study Commission. The policy statement declares: (1) the waters of Lake Michigan should be enhanced and maintained at a quality protective of public health, (2) total management (with an emphasis on recycling) should be provided for all water-borne wastes, (3) drilling and mining which threatens the ecological balance should be prohibited, (4) landfill in Lake Michigan should be prohibited without the aproval of the adjacent municipalities, the General Assembly, and the Governor, and (5) maximum possible lakefront land should be acquired for public recreational uses by the State of Illinois or public recreational uses by the State of Illinois or public recreational uses by the State of Illinois or the municipal governmental unit in which the land is located. Implementation of this policy is pro-vided through: (1) the development of a com-prehensive plan for total management of wastes generated in the land adjoining Lake Michigan, (2) initiation of a program whereby the State and local governments would have a right of first refusal on all sales of privately owned lakefront property, and (3) a program of solicitation of lakefront ease-ments from private landowners at least once every three years. (See also W72-02459) (Strachan-Chicago) Chicago) W72-02460

NEW DIRECTIONS IN STATE ENVIRONMEN-TAL PLANNING,

Institution, Smithsonian Institution, Washington, D.C. Woodrow Wilson International Center for Woodrow E. Haskell

Journal of the American Institute of Planners, Vol 37, No 1, July 1971, p 253-258. 10 ref.

Descriptors: \*Environment, \*Planning, \*State governments, \*Management, \*Decision making, Local governments, Federal government, Quality control, Pollution abatement, Consolidation, Land use, Economics, Political aspects. Identifiers: Waste management, Policy making, Implementation, Maine, Vermont, Maryland.

Some interesting trends are emerging out of the maze of state agencies involved in environmental management. Many states have begun consolidation of existing agencies and functions into pollution control agencies, or environmental 'super-de-partments'. Other states, such as Maine and Ver-mont, have initiated statewide land use control programs with systems of development permits. In Vermont, the control system will implement a statewide land use plan. In Maryland, a state agen-cy has been authorized to construct and operate solid and liquid waste treatment and disposal facilities, based on regional waste management plans. State governments see themselves as strategically State governments see themselves as strategically well located to plan and manage the environment, particularly in the area of land use and waste management. Local governments are too close to the economic and political pressures creating environmental problems, their perspective is frequently limited to their own political boundaries, and they lack the financial resources to proceed with extensive environmental planning. The Edgeral government is too far removed to deal The Federal government is too far removed to deal specifically with each state's individual problems. States have a unique constitutional power and a

#### WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

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middle layer of political and geographical perspec-tives which are required to perform effective en-vironmental planning and management. (Strachan-Chicago) W72-02466

ENVIRONMENTAL QUALITY AS A POLICY AND PLANNING OBJECTIVE, North Carolina Univ., Chapel Hill. For primary bibliographic entry see Field 06E. W72-02467

MULTIDISCIPLINARY ENVIRONMENTAL ANALYSIS - JAMAICA BAY AND KENNEDY ENVIRONMENTAL

AIRPORT, George Washington Univ., Washington, D.C. For primary bibliographic entry see Field 06B. W72-02468

INSIGHTS INTO POLLUTION. California Univ., Berkeley. R. L. Meier.

Journal of the American Institute of Planners, Vol 37, No 1, July 1971, p 211-217. 17 ref.

Descriptors: \*Pollution abatement, Pollution identification, \*Pollutants, \*Environment, \*Ecology, Planning, Decision making, Value, Manageent. Attitudes.

Identifiers: \*Taboos, Environmental belief systems, Policy making, Conceptual origins, Cultural aspects, Religious aspects, Urban society.

This article discusses some of the problems and misconceptions involved with the popular subjects of pollution and pollution control. The conceptual origins of pollution are traced back to the violation of taboos. The semantic dichotomy of 'dirty:clean' describes the arbitrary character of the taboos connected with pollution which presently exist in modern urban society. Concepts of dirt are trans-mitted at a pre-rational stage and are consequently maintained very strictly within the culture. This conceptual basis of pollution has formed the public health and esthetic order attitudes to environmental management. Environmental belief systems seem to approach religious beliefs, as the natural environment is sanctified and violations of taboos become serious crimes. This popular worship of nature may produce damaging results for the rest of society, by limiting freedom of choice and delaying the construction of necessary public facilities. A strong commitment to the simple life with Nature will only redistribute the location of pollution and therefore, does not provide a concrete solution to environmental problems. This environmental belief system should be coordinated with fundamental considerations of social organizations. Planners and policy makers must be aware of the consequences of current conflicts over environmental values and seek strategies to postpone destructive confrontations. (Strachan-Chicago) W72-02469

PLANNING LITERATURE AND THE EN-VIRONMENTAL CRISIS: A CONTENT ANALY-

SIS, Washington Univ., St. Louis, Mo. For primary bibliographic entry see Field 06B. W72-02470

PRESERVING A HUMAN ENVIRONMENT AT THE WORLD SCALE,

United Nations Center for Housing, Building, and Planning, New York.
For primary bibliographic entry see Field 06B.
W72-02471

**EQUITY AND ANTI-POLLUTION POLICY,** Institute for Defense Analyses, Arlington, Va. Proram Analysis Div.

Available from the National Technical Information Service as PB-201 489, \$3.00 in paper copy, \$0.95 in microfiche. Paper P-777, March 1971. 29 p, 7

Descriptors: \*Water pollution control, \*Economics, \*Social aspects, \*Standards, Water Peconomics, "Social aspects, "Standards, water pollution, Air pollution, Environment, Environmental engineering, Pollution abatement, Benefits, Costs, Cost-benefit analysis, Natural resources, Assessments, Legal aspects, Effluents, Water pollution sources, Planning, Legislation.

This paper discusses anti-pollution policy in terms of equitable principles. In particular, an attempt is made to highlight those aspects of policies that would have to be considered before it could be said would have to be considered before it could be said that a particular law or regulation is fair or unfair to affected parties. While the analysis provides a basis for comparing alternative policies, it does so only on the issue of equity. Three classes of anti-pollution policies are discussed: (1) taxation of the polluter in proportion to the amount or value of the pollutant, (2) establishment of a fixed permissible pollution level with enforcement backed by criminal penalties, and (3) financial compensation of the polluter to induce his attainment of a desirable pollution level. In all cases the policy is assumed ble pollution level. In all cases the policy is assumed to be applied so that the resulting pollution levels are socially optimal. Initially, the analysis is confined to a single polluter and single complainant situations, followed by application of the same principles to the situation where there are multiple polluters and multiple complainants. The paper discusses what the proper concept of pollution should be, along with certain issues associated with the level of pollution, such as the failure to enforce statutes. (Johnson-Florida) W72-02492

ENVIRONMENTAL QUALITY: THE GOVERNOR OF MARYLAND SPEAKS OUT,

Senate, Washington, D.C.

J. D. Tydings. Congressional Record, Vol 116, No 18, p S1570-72 (daily ed February 10, 1970). 3 p.

Descriptors: \*Maryland, \*Water pollution control, \*Electric power production, Pollution aspects, Air pollution, Water pollution, Pollution abatement, Legal aspects, Federal government, State governments, Local governments, Regulation, Standards, Project planning, Water pollution sources, Water pollution effects, Water conservation, Environment, Environmental effects, Electric powerplants, Nuclear powerplants.

Senator Tydings introduced the statement of Governor Mandel as a review of Maryland's program to protect its natural resources and the state position on the expansion of electrical generating plants. In the area of air pollution, Maryland has established six air quality control regions. burning dumps are being eliminated, and stringent limitations have been placed on the sulfur content of all fuel oils. Efforts have also been taken to conof all fuel oils. Efforts have also been taken to con-trol water pollution through an aggressive set of closely coordinated state and local actions. Water quality standards for all waters have been established and approved by the federal govern-ment. Water pollution control plans must be adopted by each country and approved by state regulatory agencies. After such approval, a county plan has the full effect of law and must be followed. In the area of electrical power production consideration is given to the Calvert Cliffs atomic plant and its effects upon Chesapeake Bay. The need for federal action in this area is recognized, and the Atomic Energy Commission is criticized for its emphasis on energy production to the detriment of the environment. (Horwitz-Florida)

INTRODUCTION OF THE MARINE ENVIRON-MENT AND POLLUTION CONTROL ACT OF

Senate, Washington, D.C.
For primary bibliographic entry see Field 06E.

W72-02497

CERTAIN HYGIENIC PROBLEMS ASSOCIATED WITH PESTICIDE CONTROL OF
MOSQUITOES (IN RUSSIAN),
All-Union Research Inst. of Hyg. Toxic. Pesticides,
Polymers, Plastics, Kiev (USSR).
K. K. Vrochinskii.
Gig Sanit. 35 (2), pp. 472

Gig Sanit. 35 (3): 99-100. 1970. Identifiers: Control, DDD, DDE, DDT, Fish, Human, Hygienic, Mosquitoes, Pesticide, USSR.

Studies were made of DDT, DDD and DDE content in water and hydrobiota of the Angara and Ilim Rivers to determine the long-term retention of DDT used as a larvicide against mosquitoes. High accumulation of these substances in fish (as high as 83.30 mg/kg) is seen as a hazard to man. Less stable compounds should be used for the pesticide-control of mosquitoes.—Copyright 1971, Biological Abstracts. Inc. Abstracts, Inc. W72-02509

HYGIENIC CHARACTERISTICS OF THE TREATMENT OF IRRIGATION CANALS WITH NEW CHLORINATED HERBICIDES, (IN RUS-SIAN),

For primary bibliographic entry see Field 04A. W72-02523

THE TREATMENT OF A SEWAGE STREAM WITH FENTHION FOR THE CONTROL OF CULEX PIPIENS MOLESTUS,

Ministry of Health, Jerusalem (Israel). Lab. of Entomology.

A. Barkia, D. Pickel, B. R. Lidror, and H. Shuval

Environ Health. 12 (3): 189-200. Illus. Map. 1970. Identifiers: Control, Culex-Pipiens-Molestus, Fenthion, Fever, Israel, Jerusalem, Nile, Sewage, Stream, Treatment, Vector, Virus.

C.p. molestus cause great nuisance in Jerusalem; these are widespread mosquito species and are suspected as a vector of West Nile fever virus in Israel. Control of these mosquitoes in flowing sewage in Wadi Malcha by means of steady release of fenthion emulsion is described. Fifty percent fenthion emulsion concentrate was found effective for the control of Culex breeding in flowing sewage for a distance of 10 km.-Copyright 1971, Biological Abstracts, Inc. W72-02534

THE PURIFICATION OF SEA WATER IN A SMALL CLOSED CIRCUIT AQUARIUM SYSTEM, Maxime Balloy.

Bull Inst Peches Mar Maroc. 17. 45-48. Illus. 1969. Identifiers: Aquarium, Circuit, Closed, Purification, Sea, Small, System.

The essential idea of the system described is that the water is the aquarium and associated filter system is changed after a week. The used sea water stands in a glass container for a week, and is then aerated for a week and returned to the aquarium. The system consists of a 2 l aquarium connected to a filter of calcarous elements so that about 4 l of water are constantly in circulation in this part of the system. Two 5 l glass containers are used to hold the used water before it is returned after 2 wk. A special warning against using plastic material is given.--Copyright 1971, Biological Abstracts, Inc. W72-02560

EVERYMAN'S GUIDE TO ECOLOGICAL LIV-ING, For primary bibliographic entry see Field 06G. W72-02562

LAKE MICHIGAN WATER QUALITY TRENDS. State of Illinois, Lake Michigan and Adjoining Land Study Commission.

#### Group 5G-Water Quality Control

In: Report to the Governor and the 77th General Assembly, Vol II - Supporting Studies, October 1971, p 3-70. 7 ref.

Descriptors: \*Lake Michigan, \*Water quality, \*Quality control, \*Testing, \*Reliability, \*Water analysis, Statistics, Measurements, Sampling, Onsite data collections, On-site tests, Analytic techniques, Radioactivity, Dissolved oxygen, Heavy metals, Bottom sediments, Bacteria, Tur-Heavy metals, Bottom sediments, Bacteria, Turbidity, Phosphates, Ammonia, Nitrogen, Phenols, Hydrogen ion concentration, Oil, Odor, Flotsam, Phytoplankton, Flourides, Chlorides, Sulfates. Identifiers: \*Water quality trends, \*Water quality parameters, Short term trend evaluation, Ammonia, Nitrogen, Methylene blue active substances, Cyanide, Dissolved iron, Filterable

This study attempts to identify data inadequacies and to assess past and present methods of water quality measurements in the Illinois waters of Lake Michigan in lieu of an attempt to perform com-prehensive analysis of water quality. The first major problem is the scarcity of water quality data. Such data is so scanty that even short-term evaluation of water quality trends could be highly suspect. Problems also existed in the sampling, testing, and reporting of existing data. The various sampling points differ in location from study to study. The various test methods utilized in measuring the various parameters have not been standardized between agencies and have changed from year to year within agencies. The number of parameters tested has been severely restricted, particularly with regard to heavy metals. Finally, the data acquired is often negated through obscure and con-fusing data presentation. A third problem is the lack of a framework of evaluating that data which is available. A number of tentative conclusions are drawn regarding trends in water quality with regard to several parameters. These parameters include: bacteria, turbidity, pH, phosphate, ammonia nitrogen, methylene blue active substances (M-BAS), cyanide, phenols, oil, odor, floating solids and debris, phytoplankton, bottom deposits, heavy metals, dissolved oxygen, flourides, dissolved iron, chloride, sulfate and filterable residue, and radioactivity. (Davis-Chicago) W72-02594

TOTAL WASTE MANAGEMENT: SYSTEMS. COSTS, EFFICIENCIES, OPTIONS.
State of Illinois, Lake Michigan and Adjoining

For primary bibliographic entry see Field 05D. W72-02599

CHAPTER X - THE BASIC MODEL: THE RESULTS,

RESULTS, New Mexico Univ., Albuquerque. N. Wollman, and G. W. Bonem. In: The Outlook for Water, The Johns Hopkins Press, Baltimore, 1971, p 105-120. 20 tab, 9 ref.

Descriptors: \*Flow, \*Water storage, \*Treatment, \*Costs, Management, Water quality control, Standards, Model studies.

Identifiers: \*Projections, \*Minimization, Flow

regularity, Regional shortages, Gross deficits.

The three specified combinations (referred to as programs) of flow and storage which are considered are: (1) the program that minimizes storage (required flow), (2) the program that minimizes the revel of treatment, and (3) the program that minimizes the combined cost of new storage and treatment. The twenty tables in this chapter provide figures and projections gained from applica-tion of the basic model to the following areas of concern for water management: required storage, minimum treatment program, level of treatment, expenditures for quality standards and flow regularity, regional shortages and aggregate gross deficits, and regional variations in cost—all implications derived from the basic model. In subsequent chapters, variants of the basic model are discussed.

In several regions, losses exceed maximum regulated flow, and for these regions no options are available. As a result, only minimum flow programs ere constructed for them. (Strachan-Chicago)

CHAPTER VIII - WATER QUALITY,

New Mexico Univ., Albuquerque. N. Wollman, and G. W. Bonem. In: The Outlook for Water, The Johns Hopkins Press, Baltimore, 1971, p 66-95. 30 tab, 15 ref.

Descriptors: \*Water quality, \*Water quality control, \*Wastes, \*Treatment, Tertiary treatment, Waste water treatment, Standards, Costs, Thermal

pollution.
Identifiers: \*Dilution flow, Treatment costs, Recirculation costs, Collection costs, Permanent treat-

The amount of required dilution flow is dependent on the standard of water quality that is to be main-tained, the location and characteristics of receiving waters, the amount and character of water-born waste produced by man's activities, and the level of treatment given to waste before it is discharged. The quantities of flow specified are those required to avoid violation of the quality standard under adverse seasonal conditions - i.e., periods of high air and water temperatures and naturally low stream-flows. Water quality control is discussed in terms of: amount of waste produced, dilution flows, costs of treatment, thermal pollution and recirculation costs, collection costs, short-term tertiary treatment, and short-term treatment versus lower per-manent treatment. Thirty tables are presented which present figures relating to these particular aspects of water quality control. (Strachan-Chicago) W72-02610

CHAPTER IV - CONCLUSIONS, POLICY IS-SUES, AND RESEARCH PRIORITIES, New Mexico Univ., Albuquerque. For primary bibliographic entry see Field 06B. W72-02614

SCALING METHODS FOR SURFACE AERA-TORS, Aerochem Research Labs., Princeton, N. J.

George Maise

Proceedings of the ASCE, Journal of the Sanitary Engineering Division, Vol 96, No. SA 5, p 1079-1083, October 1970, 4 ref.

Descriptors: \*Aeration, \*Performance, \*Reynolds number. \*Froude number. \*Weber number. Prototypes, Turbulence, Adsorption, Mass transfer, Turnes, Impellers.

Identifiers: \*Extended principle of similarity, \*Power consumption, \*Rotational speeds.

The Reynolds number, Froude number, and Weber numbers, of large and small aerators must be equal in order for them to be scaled directly. These three numbers all affect the tip speed of the turbine, but the first requirement states that: (1) the small turbine must run faster to simulate the viscous mixing conditions of the large turbine; (2) the second requirement states that the small turbine must run slower to have the same wave; and (3) the third requirement dictates that the small turbine must run faster, but at a different velocity than that run taster, but at a different velocity than that determined by the first requirement. Since all these conditions could not be satisfied, the extended principle of similarity was used. This principle postulates a functional relationship between the various nondimensional parameters pertinent to the system. Generalized equations were formed and assumptions were made regarding the various relationships. Values of several constants were obtained through the literature. An equation was developed for power consumption, but the oxygen adsorption process defied direct solution. The end product was two equations in three unknowns. Each variable was then set equal to zero to deter-

mine the one having the least effect on the process. By these manipulations, both power consumption and oxygen adsorption can be related for different sized similar aerators. (Lowry-Texas) W72-02668

COUNCIL REPORT.

National Industrial Pollution Control Council. Washington, D.C.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 - Price \$0.35. COM-71-50083, February 1971, 52 p.

Descriptors: \*Surveys, \*Industrial wastes, Water poliution, Air pollution, Solid wastes, Water quality control, Legislation, Waste water treatment. Identifiers: \*Liaison.

The National Industrial Pollution Control Council was created on April 9, 1970 by Executive Order 11523. The Council has identified the principal pollution control and abatement problems of theindustrial sector and is preparing reports on the progress being made to achieve desired levels of environmental quality improvement. A total of 30 sub-councils are presently functioning, covering essentially all facets of industry input, output, and waste generation problems. Members of the subcouncils are taken from the industries which the sub-council represents in the hope of stimulating interest in the programs. 16 reports, including 3 staff reports have currently been published, and efforts are also being expended in the direction of helping to speed the flow of vital technical information. The council and its sub-councils also act as liaison between industry and the various regulatory agencies, working to provide a suitable framework within which both can work to find solutions to environmental problems. (Lowry-Texas) W72-02682

MAN AND HIS ENVIRONMENT, VOL. 1, For primary bibliographic entry see Field 05B. W72-02735

PROTECTIVE PUMPING TO REDUCE AQUIFER POLLUTION, GLYNN COUNTY, PROTECTIVE

Geological Survey, Tacoma, Wash.

D. O. Gregg.

GroundWater, Vol 9, No 5, p 21-29, September-October 1971. 9 fig, 3 ref.

Descriptors: \*Water pollution control, \*Saline water intrusion, \*Aquifers, \*Groundwater move-ment, \*Georgia, Confined water, Water levels, Aquicludes, Pumping, Withdrawal, Hydrogeology. Identifiers: Glynn County (Ga).

Water-level declines in the principal artesian aquifer in Glynn County, Georgia, have created a head imbalance between the aquifer and an underlying brackish-water zone containing up to 4,550 mg/l chloride. The brackish-water zone leaks brackish water into the aquifer through several breaks in a confining unit. A relief well tapping the brackish-water zone was drilled near a suspected break and pumped at about 3,000 gpm to lower the potential in the zone and bring it into hydrostatic equilibrium with the aquifer. The pumping ap-parently succeeded in decreasing the rate of brackish-water leakage into the aquifer. Successive samples of water from a well tapping the aquifer and downgradient from the relief well showed a decrease in the chloride content. Several more relief wells may be necessary to ultimately control chloride contamination of the aquifer. (Knapp-USGS) W72-02755

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#### WATER RESOURCES PLANNING-Field 06

## Techniques of Planning-Group 6A

EFFECT OF METHOD OF MANURE HAN-DLING ON CROP YIELDS, NUTRIENT RECOVERY AND RUNOFF LOSSES, Wisconsin Univ., Madison. Dept. of Agricultural Engineering; and Wisconsin Univ., Madison. Dept. of Soils.

For primary bibliographic entry see Field 05E. W72-02852

DEVELOPMENT OF A DIAZINON-DEGRA-DING BACTERIUM IN PADDY WATER AFTER REPEATED APPLICATIONS OF DIAZINON, International Rice Research Inst., Los Banos, Laguna (Philippines).
N. Sethunathan, and M. D. Pathak.

Can J Microbiol. 17 (5): 699-702. 1971.

Identifiers: Arthrobacter, Bacterium, Brown, Degrading, Development, Diazinon, Infect-Drug, Nilaparvata-Lugens, Paddy, Planthopper, Rice-M, Streptomycin.

A decline in the brown planthopper (Nilaparvata lugens) control effectivity of diazinon was noticed after its continuous application to rice paddies for 3 1/2 yr at the International Rice Research Institute. 1/2 yr at the international Rice Research institute. In a study undertaken to determine the factor involved in this decline, rapid inactivation of diazinon was recorded within 3-5 days of its incubation with water from a rice field that received several applications of diazinon. During the same period, its degradation in water from an untreated rice field was non-significant. This indicated the development of a degrading agent in paddy water following diazinon treatments. The inactivation of diazinon on incubation with water from treated fields was retarded if the incubation mixture was sterilized or kept anaerobically. Release of 14CO2 from 14C-diazinon was rapid from water of treated fields, but was inhibited when streptomycin was added to the system. A lag of 2 or 3 days, followed by a rapid degradation, was generally evident. Thus these data established the fact that aerobic biological agents, capable of degrading diazinon in paddy water, develop after diazinon applications. A bac-terium, Arthrobacter sp., capable of metabolizino diazinon in the presence of ethyl alcohol or glucose was isolated from paddy water of treated fields.— Copyright 1971, Biological Abstracts, Inc. W72-02909

A BIOMETRICAL ANALYSIS OF THE DRAGONFLY ISCHNURA ELEGANS (VANDER LINDEN) WITH SPECIAL REFERENCE TO ITS CHLORIDE-TOLERANCE AND GENERATION NUMBER.

Ghent Rijksuniversiteit (Belgium). Laboratorium

Onent Kylsumverstell (Jegum). Laboratorium voor Systematiek Morfologie. H. J. Dumont, and S. Dumont. Blog Jaarb. 37: 50-60. 1969. Identifiers: Biometrical, Chloride, Dragonfly, Eschnura-Elegans-Elegans, Generation, Number,

Four samples of I. elegans elegans are subjected to a biometrical analysis. All samples were taken at random from populations believed to be normally distributed. Five measurable features have been tested by Student's t. Over the range covered, there is no evidence for an influence of osmotic proper-ties in the larval environment on biometry in the adult. On the contrary, well-marked differences occur between spring and summer generations that have emerged from the same water body. On comparing all samples from eutrophic waters with the one from the oligotrophic Lago Maggiore, a variable number of body-differences are encountered. Though this cannot lead to conclusive results, it must raise the suspicion of I. elegans elegans being fragmented up in a large number of, at least phenotypically, different populations. The implica-tions of such an heterogeneity are briefly men-tioned.—Copyright 1971, Biological Abstracts, Inc. W72-02922

LIMNOLOGY OF THE IOWA REACH OF THE MISSISSIPPI RIVER, lowa Univ., Iowa City. State Hygiene Lab.

Jack H. Gakstatter, and Robert L. Morris. Health Lab Sci. 8 (2): 83-88. 1971. Identifiers: City, Iowa, Limnology, Mississippi, Reach, River, Wastes.

The philosophy of the lowa Water Pollution Control Commission is to require the degree of waste treatment necessary to protect the highest water uses in the receiving stream. This philosophy encouraged formation of a Limnology Division, within the State Hygienic Laboratory, whose task was to conduct comprehensive evaluations of lowa surface water quality. The 1st priority of this division was to investigate effects on Mississippi Riverwater quality of wastes produced by the 7 largest lowa cities located on the river. All of these cities provided only primary waste treatment. The limlowa cities located on the river. All of these cities provided only primary waste treatment. The limnological investigations revealed that pollution could not be proved by chemical data alone, however, benthological and bacteriological data indicated that pollution existed downstream from 6 these 7 the contract of th dicated that pollution existed downstream from of these 7 municipal areas. This demonstrated the importance of the biological approach to water quality evaluation. The methods used in these studies, the findings, and subsequent actions by the lowa Water Pollution Control Commission are further discussed in this paper.—Copyright 1971, Philadaid Abstracts. Biological Abstracts, Inc. W72-02937

#### 06. WATER RESOURCES PLANNING

#### 6A. Techniques of Planning

REGULATION OF STREAMFLOW (REGULIROVANIYE RECHNOGO STOKA), For primary bibliographic entry see Field 04A. W72-02319

RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT: A FRAMEWORK FOR POL-

ICY ANALYSIS, Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.

Natural Resources Journal, Vol 11, No 3, p 547-560, July 1971. 2 fig, 6 ref.

Descriptors: \*Environment, \*Management, \*Simu-Descriptors. "Environment, Management, Samulation analysis, "Political constraints, "Social adjustments, "Optimization, Operations research, Economic efficiency, Costs, Mathematical models. Identifiers: "Residuals, "Policy analysis.

A comprehensive environmental quality model is presented for use in defining and evaluating specific residuals management policy alternatives. Effective use of such models requires close examination of the environmental consequences of changing the manner and amounts of goods and services produced and consumed, the type and quantity of residuals treatment and modification quantity of residuals treatment and modification and receptor protection measures. Social and political adjustments are emphasized as essential for any significant improvement in environmental quality. The model represented a static partial equilibrium analysis. In its present form the model could not be solved because of the nonlinear aspect of the residuals management problem and the lack of information regarding production functions, relating the input of resources to the production relating the input of resources to the production and consumption of goods and services, the genera-tion of residuals, the time and spatial patterns of lual concentrations in the environment, etc. With regard to public policy problems, optimiza-tion is achieved only in relation to a particular set of technical, economic, legal and political assump-tions. The optimum solution cannot be obtained. (Markell-Cornell)

STOCHASTIC PRODUCT DIFFERENTIATION. Hawaii Univ., Honolulu. Dept. of Business Economics and Quantitative Methods. G. Thomas, A. Whinston, and G. Wright.

Research Report, n. d., 19 p. 4 fig, 8 ref. OWRR B-020-IND (12), 14-31-0001-3080.

Descriptors: \*Stochastic processes, \*Optimization, \*Probability, \*Discriminatory pricing, \*Risks, Elasticity of demand, Supply contracts, Manage-Identifiers: \*Product differentiation, Pareto, LaGrange.

Based on recognition of consumer reaction to the possibility of excess demand for a good contracted for, a new theory of pricing and product differentiation was presented. The possibility of excess demand requires that the probability of delivery of a good become a parameter in the de-mand function of a good. This creates new optimal pricing rules and product differentiation by proba-bility of delivery. The creation of new goods known as stochastic product differentiation is the most imno successful product differentiation is the flost im-portant result of recognizing probability of delivery as a characteristic of a good. It provides an addi-tional decision variable thus allowing more latitude in affecting market demand and ability to separate the market according to elasticities of demand rela-tive to probability of delivery. Expected consumer surplus was used to measure consumer welfare under uncertainty and expected profit measured producer welfare. The argument was presented that stochastic product differentiation, by offering two goods with two stated probabilities of delivery, increased both total welfare and individual welfare. Responsiveness of demand to availability of delivery was used to determine conditions for stochastic product differentiation to occur. (Markell-Cornell) W72-02355

OPTIMIZATION OF POWER PLANT COOLING WATER DISCHARGE IN STREAMS,

Kansas State Univ., Manhattan. Dept. of Chemical

Engineering, L. Fan, J. Tseng, and C. Hwang. Proceedings of the ASCE, Journal of the Power Division, Vol 97, No P04, p 841-860, December 1971. 6 fig, 1 tab, 43 ref, 3 append.

Descriptors: \*Optimization, \*Mathematical models, \*Biochemical oxygen demand, \*Dissolved oxygen, \*Cooling water, \*Thermal power plants, Pollution abatement, Temperature, Water quality control. Identifiers: Streeter-Phelps.

Literature on the dynamic mathematical models of water quality in streams and the temperature effect on the Dissolved oxygen and biochemical oxygen demand concentrations was reviewed. Using the laws of conservation of energy and mass and the constitutive laws of rate and transport processes, dynamic nonlinear mathematical models for predicting temperature distribution and water quality were achieved and used to determine the optimal (economically efficient) cooling water discharge policy of a power plant. The optimal cooling water discharge policy was obtained by a direct search on the objective function which was evaluated by solving the system equations by means of quasilinearization and implicit finite difference scheme. The policy will allow plant operation without violating a predetermined stream quality criteria or criterion. A simultaneous determination was made of the spatial distribution of temperature and its temporal change and their effects on the BOD and DO distributions in a stream. (Markell-Cornell) W72-02356

SYSTEMS ANALYSIS OF WATER DISTRIBU-

TION NETWORKS, Massachusetts Inst. of Tech., Cambridge, Dept. of Civil Engineering.
R. de Neufville, J. Schaake, Jr., and J. H. Stafford.

Proceedings of the ASCE, Journal of the Sanitary Engineering Division, Vol 97, No SA6, p 825-842, December 1971. 7 fig. 1 tab, 25 ref.

#### Field 06-WATER RESOURCES PLANNING

#### Group 6A—Techniques of Planning

Descriptors: \*Simulation analysis, \*Computer pro-Descriptors: Simulation analysis, Computer programs, \*Optimization, \*Design, \*Distribution systems, \*Mathematical models, \*New York, Water distribution (Applied), Water resources, Water supply, Tunnel design.

Identifiers: Third City Tunnel.

Engineering systems analysis was presented as a procedure for integrating recent computer techniques, specifically mathematical optimization and simulation, into civil engineering. It was suggested that the systems analysis of these facilities changes the content and manner of the engineering design process and overcomes many current limita-tions on the use of computer techniques. Specifi-cally, the procedure explicitly defines multiple ob-jectives, uses mathematical formulas or models of the networks in evaluating measures of effectivethe networks in evaluating measures of effective-ness among several alternatives, searches out the optimal design strategies and configurations by sen-sitivity analysis and makes a distinction between mechanical evaluations of alternatives and the selection of the preferred design which principally involves judgment and value. The methodology was applied to an actual design problem, the planning for the \$1 billion Third City Tunnel for New York City where significant sayings and increases in rela-City where significant savings and increases in relative effectiveness were achieved. (Markell-Cornell) W72-02357

PROGRAMMING APPLICATIONS TO THE ECONOMIC PROBLEMS OF WATER QUALITY CONTROL,

Purdue Univ., Lafayette, Ind.

D. E. Pingry.
Ph.D. Thesis, August 1971, 152 p. 7 fig, 16 tab, 8 ref. OWRR B-020-IND (9), 14-31-0001-3080.

Descriptors: \*Mathematical models, \*Pollution abatement, \*Economic efficiency, \*Cost allocation, \*Simulation analysis, \*Water quality control, Basins, Pricing, Wastewater treatment, Planning. Identifiers: \*West Fork White River, \*Streeter-Phelps, \*Incremental cost.

A critical review of mathematical programming models used to select a least-cost pollution abatement program is presented in part one of this fourpart thesis. Using a general model as a guide, the basin models are classified according to objective function, quality constraints, solution technique and treatment alternatives. Proposals are made for future research priorities after considering model limitations. A large-scale nonlinear programming model in the second part improved on earlier models by considering more treatment alternatives, e.g. regional treatment plants, by-pass piping and flow augmentation, and by using a nonlinear quali-ty model. The details of the nonlinear algorithm used are discussed. The model was applied to Indiana's West Fork White River basin. The third paper presented a new cost allocation scheme based on the incremental contribution of the individual polluter to the total basin cost and applied the scheme both to the basin model in the second paper and the West Fork White River. Heat pollution and its ef-fect on the dissolved oxygen level in a river was considered in the final section. By using a tempera-ture decay equation, the Streeter-Phelps equations were modified and applied to the basin planning model. (Markell-Cornell) W72-02358

DECENTRALIZABILITY OF A STOCHASTIC OPTIMIZATION APPROACH TO WATER RESOURCE ALLOCATION, Hawaii Univ., Honolulu. Dept. of Business Economics and Quantitative Methods. G. Thomas, A. Whinston, and G. Wright. Research Report, n. d., 20 p. 4 fig, 7 ref. OWRR B-020-IND (11), 14-31-0001-3080.

Descriptors: \*Stochastic processes, \*Optimization, \*Mathematical models, \*Probability, \*Discriminatory pricing, Risks, Water resources, Elasticity of demand, Supply contracts. Identifiers: \*Pareto, \*Product differentiation.

Optimal pricing schemes for the allocation of water Optimal pricing schemes for the allocation of water resources among competing users (e.g. hydroelec-tric power, recreation, irrigation) under uncertaini-ty are discussed. The objective was to devise a decentralized method of obtaining a socially op-timal allocation. Optimal decentralization was accomplished by pricing for contingent outcomes. A price gives the potential user a certain flow at a fixed quality or a penalty fee is paid. Competing users could be sold different contracts that vary in terms of the minimum (or maximum) flow guaranteed and the penalty offered for nonperform A stochastic optimization programming model in-volving two users of an uncertain water resource was presented. Stochastic product differentiation was shown to be Pareto superior to a uniform con-tract for all users since the welfare of both the reservoir manager and the water users was in-creased by product differentiation according to probability of delivery and associated penalty cost. Prices and markets optimized the allocation processes. (Markell-Cornell)

USE OF SYSTEMS ANALYSIS IN THE DEVELOPMENT OF WATER RESOURCES MANAGEMENT PLANS FOR NEW YORK STATE, ADDENDUM,

New York State Dept. of Environmental Conservation, Albany. Bureau of Water Resources Planning. C. S. Liu, L. Brennan, and A. C. Tedrow.

Available from the National Technical Information Service as PB-205 281, \$3.00 in paper copy, \$0.95 in microfiche. Research Report, July 1971, 16 fig, 5 tab, 3 ref. OWRR C-1126 (No 1586) (2).

Descriptors: \*Simulation analysis, \*Water resources management, \*Linear programming, \*Flood control, \*Reservoir storage, Synthetic hydrology, Risk, Frequency analysis, New York. Identifiers: \*Oswego River Basin, Minimax search technique.

This report extended an earlier report whose objective was to develop tools of systems analysis for use in New York State's water resources planning. A systems analysis approach to allocate flood control storages from the lakes and reservoirs of the Oswego River System was investigated. The linear programming technique used generated a flood control utility measuring function to the monthly operations model which indicated the available storage for conservation purposes. A new simula-tion program was developed which considered alternative systems operating rules and other system configurations. A simulation analysis studied the Oswego system's ability to meet projected water demands. A systems functional evaluation included actual water deliveries and shortages and stage frequency distributions. A single reservoir operations analysis provided a tool in assisting project analysis of small-scale development in the Oswego analysis of small-scale development in the Oswego Basin study. Uncertainty in reservoir operations was assessed and the size of the reservoir storage capacity estimated using synthetic hydrology. Frequency analysis based on fixed period of observation was emphasized. Applications to the Oswego River Basin were presented. An essential element in this study was the system continuity equation—an important relation which accurately and quantitatively described how various system. and quantitatively described how various system variables interact. (See also W71-08185 and W71-08186) (Markell-Cornell) W72-02361

A SPATIAL ALLOCATION MODEL FOR PRO-A SPATIAL ALLOCATION MODIL FOR PRO-JECTED OUTDOOR RECREATION DEMAND: A CASE STUDY OF THE CENTRAL UPSTATE NEW YORK REGION, M. E. Tadros, and R. J. Kalter. Research report, Jan 1971. 78 p, 30 tab, 21 ref.

\*Recreation demand. Descriptors: Descriptors: \*Recreation defination, planning (Projected), \*Linear programming, \*Recreation facilities, \*New York, \*Spatial distribution, Boating, Sport fishing, Camping, tribution, Boating, Sport fish Swimming, Economic justification.

The allocation model presented spatially links projected market demand for specific outdoor water recreation activities to the existing and potential supply. After several approaches to the spatial allocation problem were reviewed, a linear pro-gramming model which simultaneously handles projected demand by occasion type, capacities of potentially visited recreation zones, and time, distance and cost considerations was formulated. Constraints of the model were postulated to ensure compatibility between its results and the parameters used in demand projection. The objective functions set forth were to minimize total travel time, tions set forth were to minimize total travel time, distance and cost while maximizing the quality of the sites. The model was solved according to these objectives for swimming, boating, fishing and camping in Upstate New York. Additional capacity is needed by 1985 for swimming and boating while excess capacity exists for camping. Fishing capacity demand and supply is close to equilibrium. Solution values determine requirements for additional linearing the supplements of the supplements of the supplements. values determine requirements for additional 'in-stant capacity' and translate these requirements into physical facility needs. Model performance was judged at the conceptual level and on the adequacy of available data. Sensitivity analyses can be easily performed. Model solutions provide valuable data and improve the decision-making process but do not give final economic justification. (Haugh-Wisconsin) W72-02441

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ARIZONA'S WATER ALLOCATION STUDY: AN ECONOMIC PLANNING REVIEW.

Arizona State Dept. of Economic Planning and Development. Phoenix.

Available from the National Technical Information Service as PB-201 193, \$3.00 in paper copy, \$0.95 in microfiche. Arizona Dept of Economic Pla and Development, Phoenix, Arizona, June, 1971. 19 p, 8 ref.

Descriptors: \*Input-output analysis, \*Hydrologic aspects, \*Water allocation (Policy), Linear programming, Arizona.
Identifiers: Central Arizona project.

The Arizona water allocation study which provides for rational planning and managment in the alloca-tion of water from the Central Arizona Project is described. This project will transmit water from the Colorado River to the heartland of Arizona. In order to maximize gross state product, a model was developed to most efficiently allocate the Project's estimated increment of 1.2 million acre-feet of water. This model is the synthesis of an input-output model dealing with the economic structure of the state and an engineering model depicting the hydrologic network of the state. The latter encomsses all water-related physical elements as well as their economic costs, and determines the most economic water supply for a given geographic area, be it local surface supply or a given geographic area, be it local surface supplies, local groundwater or in-terbasin transfers. The interface of these two models is a linear programming technique which (1) examines alternative production patterns which are consistent with the economic and engineering constraints and (2) allocates Arizona's water in a manner that maximizes value added. (Wade-W72-02444

ON THE ECONOMIC IMPACT OF LARGE DIVERSIONS OF SNAKE RIVER WATERS, Washington State Univ., Pullman. Dept. of Mathematics; and Washington State Univ., Pullman, Washington. Water Research Center.

Vashington: valor Research Cereb. C. B. Millham, and R. A. Russell. Water Resources Bulletin, Vol 7, No 5, p 925-934, October, 1971. 2 fig, 3 tab, 8 ref.

Descriptors: \*Diversion, \*Inter-basin transfers, \*Associated costs, \*Damages, Pollution abatement, Environmental effects, Hydroelectric power, Dynamic programming, Columbia River. Identifiers: Snake River.

#### Techniques of Planning-Group 6A

While the economic benefits of the Columbia and Snake Rivers are probably innumerable, a few of the benefits would include water for consumption, pollution abatement, recreation, navigation, power generation, irrigation, and fisheries. The possibility that some of this water might be diverted to other geographical areas raises the need for some sort of assessment of the magnitude of economic losses that would be sustained by such a diversion. Thus, a dynamic programming model is used to assess the economic losses from a number of differing volumes of diversion, removed from the Snake River at a point above Brownlee Dam, for a year having the low-flow characteristics of the period May 1928-April 1929. Continuous diversion was found to be substantially more costly than discontinuous diversion. The estimated losses apply only to water used for power generation or pollution abatement; thus, the entire true loss from diversion is, at best, substantially underestimated. (Settle-Wisconsin) W72-02448

# ROLE AND FUNCTION OF SYSTEMS ANALYSIS

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering. For primary bibliographic entry see Field 06B. W72-02482

# CHAPTER XII - VARIATIONS IN SELECTED PARAMETERS

PARAMETERS, New Mexico Univ., Albuquerque. N. Wollman, and G. W. Bonem. In: The Outlook for Water, The Johns Hopkins Press, Baltimore, 1971, p 131-152. 23 tab, 15 ref.

Descriptors: \*Variability, \*Costs, \*Biochemical oxygen demand, \*Storage, Flow, Dissolved oxygen, Economics, Recirculated water, Sewerage, Population, Pollution abatement, Environment, Planning, Decision making.

Identifiers: \*Parameters, \*Variations, Annual factor, Instream quality, Environmental pollution, Environmental improvements, Policy-making.

The basic model is based on a 2 percent chance of flow deficiency, an annual factor of 0.0425, and an instream quality standard of 4 mg/l of dissolved oxygen. This chapter examines the effect of changing ygen. I his chapter examines the effect of change, one or more of these parameters, while the under-lying economic conditions are kept unchanged. The costs of existing storage, recirculation, and col-lection (sewerage) are invariant. Therefore, 'total costs' refers to costs of treatment (BOD) plus new storage, unless it is otherwise indicated. Single variations of the parameters of chance of deficien-cy, the annual factor, and dissolved oxygen are discussed and evaluated. Further combined variations of reduction in industrial waste output, recirculation of municipal coastal intake, reservation of water for recreation, and regional characteristics are discussed. Rather than becoming engaged in freshwater manufacture and movement, the authors conclude that attention should be diverted to: (1) stabilization of population, and (2) redirection of the national bill of goods away from water-using, and water-polluting goods and services. If the present trends of environmental pollution continue, it will cost a lot of money to make any substantial environmental improvements. (Strachan-Chicago) W72-02606

#### THE OUTLOOK FOR WATER,

New Mexico Univ., Albuquerque. N. Wollman, and

The Johns Hopkins Press for Resources for the Future, Inc., Baltimore. 1971. 286 p. 7 fig, 237 tab, 6 append. OWRR B-007-N MEX (2).

Descriptors: \*Management, \*Water resources development, \*Planning, \*Decision making, \*Future planning (Projected), \*Economics, Water supply, Water quality, Supply, Demand, Regional analysis, Model studies, Aesthetics, Population, Water users, Flow, Costs.

Identifiers: \*Projections, \*Comprehensive projections, \*Systematic economic model, \*Policy-making, \*Economic activity, National analysis, Coefficients, Withdrawal uses, Water uses.

The study seeks to develop a systematic economic model that: (1) recognizes the regional aspects of the water problem yet yields a national perspective, (2) permits aggregation of demand and supply into usefully parallel concepts, (3) takes into account the fugitive and probabilistic characteristics of supply as well as the interdependence between supply and demand, and (4) identifies important choices to be made and tensions to expect within and among water resource regions. Another important aspect of this study is the concern for the incorporation of aesthetic judgements within the body of an economic analysis of water resources. The authors maintain that there is an urgent need for well-developed techniques of comprehensive projection for future water supplies and requirements, so that wise planning of water resources will become a reality. The book is divided into two major parts. The first part describes the study briefly in terms of the conceptualization of the problem and the approach to it, the basic model and variations upon it, a summary of findings, and discussion of policy issues and research priorities. The second part presents more detail in the form of projections for population and economic activity to the year 2020, coefficients of water use and withdrawal uses, water quality, water supply and the costs of flow, short-term tertiary treatment, and variations in selected parameters of the basic model. (Strachan-Chicago)

# CHAPTER III - A SUMMARY OF THE

New Mexico Univ., Albuquerque. For primary bibliographic entry see Field 06B. W72-02617

# CHAPTER II - THE BASIC MODEL AND ITS VARIATIONS,

New Mexico Univ., Albuquerque. N. Wollman, and G. W. Bonem. In: The Outlook for Water, The Johns Hopkins Press, Baltimore. 1971. p 6-17. 2 fig, 13 ref. OWRR

Descriptors: \*Water resources development, \*Water supply, \*Water demand, \*Economics, \*Model studies, Planning, Decision making, Regional analysis, Supply, Demand, Water requirements.

Identifiers: \*Economic model, \*Water use, \*Water resource region, Incorporation, National analysis, Deficit and surplus, Comprehensive projections.

The five essential steps in this economic model are outlined. Attention is confined to the forty-eight contiguous states and restricted definitions of 'supply' and 'demand' are maintained. (1) The supply of fresh water for each of the twenty-two water resource regions is calculated at three levels - the flow that can be depended on 98 percent, 95 percent, and 90 percent of the time. (2) Water 'requirements' for each of the regions are estimated for the years 1980, 2000, and 2020. (3) Estimates of supplies are compared with the requirements of each region. (4) Three alternative types of programs for meeting indicated regional deficits are developed and their estimated costs compared. The alternative programs are based on: (a) minimum levels of treatment, (b) minimum storage, (c) minimum cost. The limitations and deficiencies of this model are discussed in detail. The authors indicate seven uses of this study. (1) It incorporates many bits of information into a decision framework. (2) It incorporates quality considerations into a consistent set of statistics on regional requirements. (3) It permits a view of water both as a national and a regional resource. (4) It reveals a range of possible behavior and various bases for action regarding water resource use and supply. (5) It can forecast the location aid magnitude of water deficits and surpluses. (6) It can indicate mag-

nitudes of investment likely to be required. (7) It will point the way to more comprehensive and refined projections of water supply and demand. (Strachan-Chicago) W72-02618

# RESOURCE INVESTMENTS, IMPACT DISTRIBUTION, AND EVALUATION CONCEPTS,

Cornell Univ., Ithaca, N.Y.
R. J. Kalter, and T. H. Stevens.
American Journal of Agricultural Economics, Vol
53, No 2, p 206-215, May, 1971. 10 tab, 32 ref.

Descriptors: \*Resource development, \*Planning, \*Economic impact, Cost-benefit analysis, Mathematical models, West Virginia. Identifiers: \*Income distribution, \*Equity consequences, Stonewall Jackson Reservoir (West Virginia).

Evaluation of alternative proposals for governmental resource investment has normally not been carried out within a multiobjective framework. The single-valued objective function of national economic efficiency has been the mainstay of governmental analysis. As a step toward correcting this shortcoming, a model designed to facilitate the measurement and evaluation of equity consequences of government programs is specified and applied to a case study. The model can be used in conjunction with different equity classifications, but the case study considers only the personal income distribution consequences of the proposed multipurpose Stonewall Jackson Reservoir in West Virginia. This trial application of the equity model suggests that the project would have a positive effect on all income classes in the defined region because the region would not be required to pay even a major share of the costs. This is true even though the project from the national efficiency viewpoint is inefficient. Furthermore, the project would result in a slight distributional effect in favor of the lower income group even though the relative distribution of benefits would tend to favor the middle income group. (Settle-Wisconsin) W72-02641

#### ZERO POLLUTION: A TRADEOFF ANALYSIS,

Boston Univ., Mass. R. Jackson.

The Southern Economic Journal, Vol 38, No 1, p. 97-100, July, 1971. 2 fig, 1 tab, 7 ref.

Descriptors: \*Pollution abatement, \*Legislation, \*Welfare (Economics), Taxes, Social impact. Identifiers: \*Pollution control, \*Consumer's surplus, \*Producer's surplus, Polluters.

The two main approaches to pollution control involve either a corrective tax equal to the marginal damage caused by the pollution, or rigid legal standards to which polluters must comply. Pollution control by decree may create nonoptimalities, but on balance may be preferred when the costs of estimating and collecting corrective taxes are considered. A model developed to evaluate possible decree-associated nonoptimalities shows that (1) market power tends to reduce the acceptable costs of eliminating pollution entirely though when industry demand is inelastic the fact that the industry is not perfectly competitive is not a significant consideration; (2) the elasticity of demand is an important factor in determining these critical costs and the direction of its effect is dependent on market structure; (3) in competitive markets or where market power is low relative to the damage caused by the externality, the cost per unit of output required to eliminate pollution can be greater than the damage per unit of output imposed on others and still result in a welfare gain to society. (Settle-Wisconsin) W72-02646

# THE OPPORTUNITY COST OF POLLUTION ABATEMENT IN A STEADY-STATE EXPANDING ECONOMY.

Arizona Univ., Tuscon.

#### Field 06-WATER RESOURCES PLANNING

### Group 6A—Techniques of Planning

F. J. Alessio.

The Annals of Regional Science, Vol. 5, No. 1, p 84-92, June, 1971. 4 fig, 3 ref.

Descriptors: \*Pollution abatement, \*Estimated benefits, \*Mathematical models, Environmental effects, Economics, Tangible benefits, Intangible benefits.

Identifiers: \*Economic growth, \*Opportunity costs, Environmental quality, Steady-state economy.

A neo-classical one-sector growth model is utilized to show the simple theoretical impact of pollution abatement on the performance of the economy over time, and to identify the opportunity cost of preventing environmental deterioration. A comparison of two growth models, one with pollution and one without, suggests that some consumption of the homogeneous commodity must be foregone as a result of the anti-pollution measures. This lost consumption is the opportunity cost to society of improving and maintaining the quality of the environment. Opportunity cost is not a measure of the net cost to society of forestalling environmental deterioration; it simply represents the additional amount of the homogeneous commodity that society could have consumed had it been willing to endure environmental deterioration. The theoretical measure of the net benefit to society is the psychic satisfaction gained from the clean environment less the satisfaction loss associated with the opportunity cost. It may not be positive in all cases. (Settle-Wisconsin) W72-02656

#### **6B. Evaluation Process**

ANALYSIS OF ALTERNATIVE PROCEDURES FOR THE EVALUATION OF AGRICULTURAL FLOOD CONTROL BENEFITS, VOLUME II, Economic Research Service, Washington, D. C. D. Piper, A. R. Strohbehn, and B. R. Boxley. Available from the National Technical Information Service, Springfield, Va., 22151, \$3.00 in paper copy, \$0.95 in microfiche. Army Corps of Engineers Institute for Water Resources Report IWR-71-4, July 1971. 117 p, 26 tab, 2 append.

Descriptors: \*Flood damage, \*Agricultural watersheds, \*Flood protection, \*Benefits, \*Model studies, Land use, Land appraisal, Land management, Project benefits, Economics, Linear programming, Mathematical studies, Costs. ldentifiers: Land value, Flood risks.

Alternative methodologies to the frequency-damage procedure for estimating agricultural crop flood control benefits are evaluated. An extension of the Economic Research Service Regional Linear Programming model to the case of project analysis was made. The RLP model operates in the same way as a basin wide firm and estimates the change in production costs (out of pocket cost) as flood protection measures are provided. Efficiency benefits are equal to decreases in production costs, since output is held constant. Critical assumptions and several major empirical problems encountered during the study are discussed. A synopsis is made of the utility of the land value approach, the regional linear programming approach and the frequency-damage approach. (Woodard-USGS) W72-02269

AGRICULTURAL FLOOD CONTROL BENEFITS AND LAND VALUES.
Corps of Engineers, Alexandria, Va. Inst. for Water Resources.

Available from the National Technical Information Service, Springfield, Va., 22151, \$3.00 in paper copy, \$0.95 in microfiche. Army Corps of Engineers Institute for Water Resources Report IWR 71-3, June 1971. 178 p, 2 fig, 20 tab, 7 append.

Descriptors: \*Flood control, \*Agricultural watersheds, \*Benefits, \*Flood protection, \*Mis-

souri River, Reviews, Theoretical analyses, Regression analysis, Hydrology, Runoff, Drainage, Topography, Mathematical studies.

Identifiers: \*Missouri River basin, \*Wabash River basin, Land values.

This monograph presents the experience which the Institute for Water Resources has accumulated through two detailed and carefully controlled applications of a land value approach to estimate the benefits accruing to the agricultural sector from flood control projects. Treatment of both the theoretical basis and practical applications are included. The main concern is with a rather detailed exposition of the statistical analysis of areas in the Wabash and Missouri River Basins. In this respect it is written primarily for use at the field levels of the Corps of Engineers to serve as a guide to the use of the approach in terms of the types of data required, the form of the data for use in the regression model, and the interpretation of the estimated regression model. (Woodard-USGS) W72-02270

WATER RESOURCES PLANNING IN URBAN DEVELOPMENT.

DEVELOPMENT, Wapora, Inc., Washington, D. C. B. Baratz, and B. J. Wachter.

D. Daratz, and B. J. Wachter. Available from NTIS, Springfield, Va. 22151 as PB-200 085, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, 1971, 151 p, 18 fig, 7 tab, 50 ref, 7 append. OWRR C-2130 (No. 3368) (1).

Descriptors: \*Urban renewal, \*Water supply, \*Water demand, \*Water users, \*City planning, \*Long-term planning, \*Multiple-purpose projects, \*Optimum development plans, \*Recreational demand, area redevelopment, Zoning, Planning, Local governments, Water rates, Water costs, District of Columbia.

Identifiers: \*Washington, D.C., \*Fire flow regulations, \*MAIN II Computer progrNm, non-potable

The study covered a detailed investigation of water resource planning in the Southwest Urban Renewal Project of Washington, D. C. This entailed consideration of institutional, financial, and recreational aspects of water resources as well as en-gineering details. A recent systems methodology available for computing water requirements urban areas was utilized as a means of testing its validity in the Southwest project. From a comprehensive survey, additional cities with extensive urban renewal activity were selected and visited. Data from these cities were compared to the Washington, D.C. information. The results were incorporated into a series of guidelines for both urban and utilities planners. Some of the areas identified as needing further consideration include:
(1) Greater exposure of utility engineers to the systems engineering studies for metropolitan water systems engineering studies for methodical water planning; (2) Greater attention to recreational aspects of water resources planning (3) Reconcilia-tion of the difference between urban renewal and city planning personnel; (4) Examination of fire flow requirements for urban renewal projects; (5) Consideration of alternative methods of using non potable water for such purposes as sprinkling, toilet flushing, fire requirements, etc. Although urban l does not represent an engineering challenge for water supply, further attention is needed to ascertain what efficiencies and economies might be effected by more detailed attention to planning inner-city renewal. W72-02294

A STUDY OF PUBLIC ATTITUDES AND MUL-TIPLE OBJECTIVE DECISION CRITERIA FOR WATER POLLUTION CONTROL PROJECTS, Georgia Inst. of Tech., Atlanta. School of Industrial

and Systems Engineering. Gerald J. Thuesen.

Available from the National Technical Information Service as PB-205 181, \$3.00 in paper copy, \$0.95 in microfiche. Environmental Resources Center, Georgia Institute of Technology, Report ERC-1071, October 1971. 70 p, 8 fig, 3 tab, 40 ref, 2 append. OWRR A-028-GA (1).

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Descriptors: \*Attitudes, \*Public behavior, \*Behavioral measurement, \*Decision making, Performance measurement, Assessment structure, Social aspects, Social impact, Economic impact, Water management.

Quantitative methods for translating public attitudes and conceptions about water quality into criteria that would be useful for evaluating alternative courses of action in planning water quality control projects were investigated with an objective of providing the decision-maker more useful and objective information. This objective was accomplished by developing an assessment structure for quantitatively measuring the impact of water quality, measuring the value of information obtained in the assessment structure, and assessing preferences among alternative actions in planning water quality control projects. Primarily, the emphasis of the research is to identify and quantify the non-monetary factors of water quality which have an impact on the public. A systematic procedure for developing a multiple objective assessment structure is presented so that water quality can be incorporated into the planning process as a multi-variate consideration. (Conway-Georgia Tech)

INTERBASIN TRANSFERS OF WATER, ECONOMIC ISSUES AND IMPACTS,

Colorado Univ., Boulder. Dept. of Economics; and Minnesota Univ., Minneapolis. Dept. of Economics. For primary bibliographic entry see Field 03B. W72-02436

UPPER MISSISSIPPI RIVER COMPREHENSIVE BASIN STUDY, APPENDIX P, VOLUME VIII, ECONOMIC BASE STUDY AND PROJEC-TIONS. 1970.

Corps of Engineers, Chicago, Ill. North Central

194 P, 61 FIG, 107 TAB.

Descriptors: \*Future planning (Projected), \*Water resources development, \*Water requirements, \*Mississippi River Basin, \*Economics, Employment, Income, Industrial production, Human population.

Identifiers: \*Economic changes, Personal income.

As one of the nine appendices to a comprehensive study of the Upper Mississippi River Basin, this report develops the necessary information regarding future economic and demographic changes in the Basin to serve as a guide in projecting future water requirements and developing a water resource plan. Trends and projections of these changes are developed for the Nation, Multistate Region, the Basin, Economic Subregions and Plan Areas, accompanied by an analysis of their interrelationships. Four economic parameters serve as the basis for these projections: population (farm versus nonfarm), employment (for major industry groups), production (in agriculture, minerals, forestry and electric power) and personal income. Based on these criteria, it was concluded that the Upper Mississippi River Basin is expected to continue to grow at a more rapid pace than its multistate area, but slightly less than the national pace. The final section of the report summarizes the approaches used in applying this information to water resource planning by the study's many participants. (Haugh-Wisconsin)

ECONOMY ASPECTS OF DESALTING APPLICATION, TULAROSA BASIN OF NEW MEXICO.

New Mexico State Univ., University Park. New Mexico Water Resources Research Inst. H. R. Stuky. Water Resources Bulletin, Vol 7, No 5, p 913-919, October 1971. 2 fig, 2 tab, 5 ref.

Descriptors: \*Desalination, \*Groundwater basins, \*Groundwater, \*Saline water, Water demand, Water supply, Project feasibility, Estimated Identifiers: Alamogordo (New Mexico).

The fresh water requirements of the residents of New Mexico's Tularosa Basin are presently met by water piped from either Bonito Lake or Alamo water piped from either Bonto Lake or Alamo Canyon. This water is of good quality, but the supply from these sources is limited. Consequently, a three-pronged research project designed to analyze the feasibility of desalting the Tularosa Basin's saline groundwater was organized through the Water Resources Research Institte. If desalting were feasible, the Basin could utilize at least some of the estimated 150,000,000 acre-feet of saline water it has in groundwater storage. Initially five sites were selected as areas for study; however, as the research and investigation continued, all but two sites were eliminated from consideration for more detailed analysis. These two sites, near Alamogordo, New Mexico, represent possible loca-Alamogoruo, new meaner, represent possion income to the sites indicate that the water ranges from 2,140 to 11,640 milligrams per liter total dissolved solids at one site, and 1,510 to 6,464 at the other site. At both sites the water in very high in sulfate content. Brine the water is very high in sulfate content. Brine disposal areas for both proposed locations are available and present no special problems. (Settle-Wisconsin) W72-02447

ECONOMIES ASSOCIATED WITH SIZE OF WATER UTILITIES AND COMMUNITIES SERVED IN NEW HAMPSHIRE AND NEW EN-GLAND, New Hampshire Univ., Durham. Inst. of Natural

and Environmental Resources. For primary bibliographic entry see Field 06C. W72-02451

# RECREATIONAL PARKS AND BEACHES: PEAK DEMAND, QUALITY AND MANAGE-

California Univ., Davis.

K. D. Goldin.

Journal of Leisure Research, Vol 3, No 2, p 81-107, 1971. 8 fig, 3 tab, 31 ref.

Descriptors: \*Beaches, \*Parks, \*Resource allocation, \*Recreation demand, \*Cost-benefit analysis, Recreation facilities, Pricing, Land use, Manage-

There are three persistent and related problems at user-oriented state parks and beaches. First, user demand varies tremendously, with peak demand during the summer season and on weekends and holidays. A second problem involves both the quality level and the extent of quality diversity.

Ouality aspects include use intensity, improvements, proximity to users, and 'availability. third problem is management, its methods and in-centives. Through the use of rules like first-comefirst-served and seasonal use limits, the present system of state parks and beaches achieves a satisfactory solution to these problems; however, these solutions appear to be non-optimal. Optimal allocation is to users with the highest user benefits, which requires complex rules or a price which completely allocates the available capacity. Furthermore, practices such as uniform pricing are inconsistent with an optimal menu of quality diversity. Again, a price system or complex set of rules would be necessary to achieve optimal quality levels. Nonoptimalities arise, at least in part, from receives. Reinoplimatites arise, at least in part, from the incentives facing park and beach managers. Presently, managers neither rely on the pricing method nor are they pressured by competing suppliers. Optimality considerations would require, however, that managers face some such competitive incentive. (Settle-Wisconsin) THE USE OF MARKET SEGMENTATION IN PLANNING FOR A RECREATION-BASED ECONOMY,

Wisconsin Univ., Madison. Graduate School of Business Administration.

W. S. Strang.
The University of Wisconsin Sea Grant Program, Technical Report No 5, February, 1971. 45 p, 27 tab, 8 ref, 1 append. WIS-SG 71-205.

Descriptors: \*Tourism, \*Recreation, \*Input-output analysis, \*Economic impact, \*Marketing, \*Expen-

Identifiers: \*Market segmentation, Segment mul-tiplier, Door County (Wis).

The recreation-based economy of Door County, Wisconsin, was analyzed by breaking the local market into buyer segments and relating each segment to expenditures produced. Touristparty expenditures were analyzed in relation to household in-come, occupation, age, size of party, residence, type of accommodation, and the primary recreation activity engaged in. Using industry multipliers generated from a previously developed input-out-put model of Door County, multipliers were put model of Door County, multipliers were developed for each market segment found to be im-portant in the first part of the study. Because of higher expenditures per party and higher segment multipliers, the higher income, older age, manager and proprietor and sales worker, hotel and resort and tourist home customer groups had the greatest positive economic impact. Using this data, it was suggested that a marketing strategy could be developed which consisted of (a) shaping the outdeveloped which consisted of (a) snaping the out-door recreation opportunities to these segments and (b) aiming promotion at particular market seg-ments to produce the greatest positive expenditure impact. (Wade-Wisconsin) W72-02456

# ECONOMIC ANALYSIS OF WATER SUPPLY ALTERNATIVES IN A MULTI-COUNTY IN-

DUSTRIAL AREA, Clemson Univ., S.C. Dept. of Agricultural Economics and Rural Sociology. G. H. Liner.

Clemson University, Clemson, South Carolina, Ph.D. Thesis, May, 1971. 127 p, 12 fig, 15 tab, 42 ref, 4 append. OWRR A-021-SC (1).

Descriptors: \*South Carolina, \*Water supply, \*Surface waters, \*Future planning (Projected), \*Water distribution (Applied), \*Water utilization, \*Total costs, Employment, Legal aspects, Economies of scale, Variable costs, Fixed costs, Interest rate, Markov processes.
Identifiers: \*Broad River Basin, Network flow

Based on current and projected water use rates, only Greenville and Spartanburg counties (of the ten counties studied in the Broad River Basin of South Carolina) will need supplementary water supply sources between 1970 and 2020. Expected water needs were compared to existing surface supplies (estimated from stream flow and municipal water system data). The water supply sources considered for the two counties were Duke Power Company's Keowee-Toxaway Project and the proposed Clinchfield Reservoir. Statistical cost functions were used to determine the least cost supply alternative. The transmission (optimal capacity increments and pumping costs), purchase price and treatment costs of water at these two sources were estimated. Considering all combinations of water supply costs, the Keowee-Toxaway Project proved to be the most economical source of water for Greenville County. However, because legal and political considerations arising from the inter-basin transfer of water from Savannah to Broad would result in costly delays, the Clinchfield Reservoir may be a more economical source, as it already is for Spartanburg County. A need for better surface and ground water supply data, better water-use information and research on inter-basin transfer problems is indicated. (Haugh-Wisconsin)

NEW APPROACHES TO COMPREHENSIVE PLANNING IN CANADA, Department of Energy, Mines and Resources, Ot-tawa (Ontario). F. J. Forbes, and R. C. Hodges. Water Resources Bulletin, Vol 7, No 5, October 1971, p 1059-1070. 1 fig, 1 tab, 2 ref.

Descriptors: \*Planning, \*Water resources development, \*Management, \*Decision making, Basins, Economics, Social aspects, Legislation, Jurisdiction, Environment. Identifiers: \*Comprehensive planning, \*Canada, Qu'Appelle River Basin.

In 1970, the Canadian Federal Government passed the Canada Water Act which provides for a cooperative federal-provincial approach to water resources management. The purpose of this paper is to outline our definition of comprehensive planning and the approach being taken under the new legislation. Two basic premises underly the definition. They are that resource management consists of an array of problems and that the prime definition. They are that resource management consists of an array of problems and that the prime function of planning is to provide information for decision making. The definition of comprehensive planning is embodied in a general statement and a set of principles. The principles define the approach that should be taken to provide adequate information for decision making in today's complex environment. A brief resume of the jurisdictions for water management in Canada leads to a discussion of a joint federal-provincial comprehensive study of the Qu'Appelle River Basin in Southern Saskatchewan. The basin and the study are described briefly. This is followed by an outline of of the Qu'Appelle River Basin in Southern Saskatchewan. The basin and the study are described briefly. This is followed by an outline of the economic and social considerations which are being incorporated into the comprehensive planning study for the basin. (Strachan-Chicago) W72-02462

### OPINIONS RELATING TO FLUORIDATION: DEVELOPMENT OF MEASURES, Georgia Inst. of Tech., Atlantic. School of

For primary bibliographic entry see Field 05F. W72-02463

ECOLOGY AND PLANNING, British Columbia Univ., Vancouver.
C. S. Holling, and M. A. Goldberg.
Journal of the American Institute of Planners, Vol 37, No 1, July 1971, p 221-229. 3 fig, 25 ref.

Descriptors: \*Ecology, \*Planning, \*Decision making, Institutions, Insecticides, Urban renewal, Ecosystems.

Ecosystems. \*Ecological systems, \*Urban systems, Complexity, Borneo, Peru.

Basic similarities are delineated between the con-cerns of ecologists and of planners. Complex urban systems and ecological systems are characterized by four distinctive properties: (1) functioning as in-terdependent systems, (2) dependence on a succes-sion of historical events, (3) spatial linkages, and (4) nonlinear structure. Both systems appear to have considerable internal resilience within a cer-tain domain of stability. It is objust however, that nave consideration internal resinence within a certain domain of stability. It is obvious, however, that programs which upset the complex balance of either system, such as insecticide spraying and urban renewal, generate unexpected and unfortunate results. The examples used are malarial control in Borneo and a cotton ecosystem in Peru. Use of an ecological framework for planning suggests or an ecological trainework for planning suggests mew principles which are based more upon our ignorance of the urban and ecological systems, than upon our concrete knowledge of these systems. Three conclusions are suggested for the consideration of planners and decision makers: (1) that the actions of planners and decision makers be limited in scope and diverse in nature, (2) that complexity be a worthwhile goal to be preserved and encouraged, and (3) that a more boundary oriented view of the world be adopted. The size of our institutions must be reduced to ensure their flexibility and respect for the system of which they are an interacting part. (Strachan-Chicago) W72-02464

#### Field 06—WATER RESOURCES PLANNING

#### **Group 6B—Evaluation Process**

ENVIRONMENTAL RESIDUALS MANAGEMENT, Resources for the Future, Inc., Washington, D.C.

Quality of the Environment Program.

Journal of the American Institute of Planners, Vol 37, No 1, July 1971, p 218-220. 8 ref.

Descriptors: \*Environment, \*Planning, \*Manage ment, \*Quality control, \*Natural resources, Social aspects, Economics, Optimization, Value. Identifiers: \*Residuals management, \*Environmental quality management, Services, Affluent society, Resource use, Raw materials, Assimilative capaci-

Since environmental resources are 'common property resources' with no prices attached to their services, and incapable of being exchanged between buyers and sellers in a market context, the usual mechanism in a market economy is not effec-tive in limiting the use of environmental resources. The result is an excessive use of the natural environment accompanied by pollution and the need for collective or public management. Residuals are operationally defined as comprising, at a given point in time, the difference in weight and energy between the fuel, food, and raw material inputs to production and so-called consumption activities, and the outputs of those activities. The pervasiveness of residuals generation, the factors influencing the generation, and the role of the environment in providing residuals assimilation services are topics which are discussed. Certain social issues and chowhich are discussed. Certain social issues and choices are reflected in this discussion of residual management: (1) the demands of an affluent society, (2) policy decisions in relation to types of raw materials permitted for use in production processes, levels of environmental quality desired, etc., (3) consideration of time and spatial varia-

MULTIDISCIPLINARY ENVIRONMENTAL ANALYSIS - JAMAICA BAY AND KENNEDY

tions of assimilative capacity, (4) consideration of

total economic impact of environmental quality management, and (5) discovery of the optimal mix of elements necessary to achieve environmental quality. (Strachan-Chicago) W72-02465

George Washington Univ., Washington, D.C. D. C. McGrath, Jr.

Journal of the American Institute of Planners, Vol 37, No 1, July 1971, p 243-252. 4 fig, 8 ref.

Descriptors: \*Environment, \*Planning, \*Conserva-tion, Airports, Air pollution, Water pollution, Ecology, Recreation.

Ecology, Recreation.

Identifiers. \*Jamaica Bay, \*Kennedy International Airport, \*Comprehensive planning, \*Urban development, Aviation use, Noise pollution.

The recently completed study of Jamaica Bay and Kennedy International Airport which was undertaken by the National Academies of Sciences and Engineering (1970-71) for the Port of New York Authority (PONYA) demonstrates the importance of commencial and the contract of the commencial and the contract of the commencial and the c portance of comprehensive planning and suggests the range of factors that 'environmental impact stu-dies' should include. The case of Kennedy International Airport and Jamaica Bay illustrates basic conflicts between environmental conservation and urban development. Aviation use increases result in degradation of the natural aspects of the bay; yet curtailment of aviation growth has serious implica-tions for the future development of New York. Four principal conclusions were made. (1) Any further runway construction would damage the natural environment of the bay and reduce its potential use for conservation, recreation, and housing. (2) Improvement of the bay environment nousing. (2) Improvement of the bay environment can be accomplished through technological means, independently of any airport expansion. (3) Reduction of noise pollution for nearby residents will not occur from the construction of new runways, but only from the use of quieter aircraft. (4) The ecological viability of Jamaica Bay can only be maintained if there are no further incursions into maintained if there are no further incursions into the area. Since the environmental study group was

not bound by limits on organization of planning functions and was free from the pressures of politi-cal expediency, it was able to develop a planning perspective for both Jamaica Bay and Kennedy Airport which took into consideration the problems of both environmental conservation and urban development. W72-02468

INSIGHTS INTO POLLUTION, California Univ., Berkeley. For primary bibliographic entry see Field 05G. W72-02469

PLANNING LITERATURE AND THE EN-VIRONMENTAL CRISIS: A CONTENT ANALY-

VIRON MEN AND SIS, Washington Univ., St. Louis, Mo. T. D. Galloway, and R. J. Huelster. Journal of the American Institute of Planners, Vol 37, No 1, July 1971, p 269-273. 1 fig, 3 tab, 20 ref.

Descriptors: \*Planning, \*Environment, Methodology, History, Resources, Technology, Psychological aspects. Identifiers: \*Content analysis, \*Natural environmental issues, Planning theory, Comprehensive

A content analysis of selected planning literature from 1950-1969 is the main concern of this article. Planning literature has given marginal concern to natural environmental issues, although an increased awareness of environmental problems is observable within planning literature. Two approaches of the planning professions to environmental questions are distinguished: (1) marginal at-tention delegated to natural environmental issues as they are incorporated within other concerns, such as historical perspectives, case studies of com-prehensive planning, and the generic category of natural resources; and (2) emphasis upon man's interaction with an environment of his own creation accompanied with attention to the scientific and technological aspects, and the psychological and physiological effects upon man as he interacts with his own created environment. The authors conclude that the planning professions have either regarded natural environmental issues in a tangential way, or with a cosmic viewpoint. Consequently, neither viewpoint has had any utility in the development of substantive planning theory and methodology. (Strachan-Chicago)

PRESERVING A HUMAN ENVIRONMENT AT THE WORLD SCALE,

United Nations Center for Housing, Building, and Planning, New York. R. May, Jr.

Journal of the American Institute of Planners, Vol 37, No 1, July 1971, p 266-268. 1 tab, 5 ref.

Descriptors: \*Environment, Resources, \*Resource development, \*Planning, Population, Urbanization, Exploitation, Economics, Documents. Identifiers: World Conference on the Human Environment, \*International aspects, \*Developed countries, \*Developing countries, Economic development, Resource depletion.

The agenda for a World Conference on the Human Environment to be held in Stockholm in 1972, called for by the United Nations General Assembly, is discussed. International aspects of the environment fall under four general headings: (1) actions to protect world resources, (2) actions at regional or bi-national levels to protect and prevent the depletion of specific natural resources, (3) actions to protect and preserve significant aspects of the man-made environment of cultural, historic, aesthetic and scientific value and interest within nations, and (4) actions dealing mainly with the special problems of developing countries, to help in improving their environmental conditions and to prevent unnecessary exploitation of their essential

economic development. Problems of developing countries deserve increased attention because of their rapidly growing populations and their growing rate of urbanization. The author makes three suggestions in the area of dealing with environmental problems of developing nations: (1) developed nations should aid developing nations in accelerating their economic growth without detriment to the environment (2) developing nations the detriment to the environment (2) developing courselves about details. vironment, (2) developing countries should set up environmental planning and management mechanisms, and (3) developing countries and developed countries should assume joint responsi-bility for improved environmental development through international actions and programs. The developing world needs such guidelines if it is not to repeat the mistakes of previous developing countries on a larger scale. (Strachan-Chicago) W72-02471

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THE FUTURE OF THE ADIRONDACK PARK, Adirondack Museum, Blue Mounatain Lake, New

W. K. Verner, and M. B. Lapping. Journal of the American Institute of Planners, Vol 37, No 1, July 1971. p 280-283. 14 ref.

Descriptors: \*Planning, \*environment, \*Conserva-tion, \*Recreation, \*Land use, Control, Coordina-tion, Parks, Scenic easements, New York. Identifiers: \*Adirondack region, \*Wilderness area, \*Policy making, Implementation, Vested interests,

The Adirondack region is the Federal government's largest park area and the largest collection of wilderness areas in public ownership in the Northeast. It has existed as a prime recreational and wilderness area in the midst of the most highly urbanized and industrialized part of the nation. The Temporary Study Commission on the Future of the Adirondacks (TSCFA) was appointed by Governor Rockefeller to implement a program of development and conservation of the environment in this region. The primary recommendation of the Commission is the establishment of an 'independent, mission is the establishment of an independent, bipartisan Adirondack Park Agency ... with general power over the use of private and public land in the Park.' This agency is conceived of as a planning and land use control authority charged with the responsibility of developing a regional plan for the Park and the coordination of activities that might fall under the heading of 'land use control'. Suggestions of heavy use of the planning tool of scenic easements and discussions of the complexities of the term 'wilderness' formed other concerns of the Commission. The Commission's recommendations and suggestions represent a model of pragmatism, which tries to account for all possible vested interests in the region. These various vested interests make immediate implementation of the Commission's program impossible. Furthermore, the generation of sufficient broad public opinion to press implementation of the program does not seem possible at this time. (Strachan-Chicago) seem possible W72-02472

URBAN WATER RESOURCES MANAGEMENT - 3RD CONFERENCE ON URBAN WATER RESOURCES RESEARCH, JULY 27-31, 1970. RESOURCES RESEARCH, JULY 27-31, 1970, DEERFIELD, MASSACHUSETTS, SPONSORED BY THE URBAN WATER RESOURCES RESEARCH COUNCIL OF THE HYDRAULICS DIVISION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

American Society of Civil Engineers, New York.

Available from ASCE, 345 E. 47th St., New York, N.Y., 10017, \$8.00. 1971. 132 p, 2 append.

Descriptors: Water resources, \*Management, \*City planning, Cities, Ecology, Social aspects, Decision making, Planning, Environment. Identifiers: \*Metropolitan water resources management, Implementation, Management systems.

The conference recommended twenty-eight specific research needs; the research needs in

urban water resources management included: (1) a much greater need for research in the social and much greater need for research in the social and ecological areas; (2) a need to reduce the time lag between the planning stage and implementation of water resources programs; (3) solving problems in decision making stemming from the competition between technical and social alternatives and solutions; (4) devising methods of overcoming the situation where technical and social alternatives tend to dominate the decision making and management systems to the exclusion of environmental and ecological alternatives and solutions; and (5) determining how the engineering profession can more readily involve itself in the related ecological, social and environmental problem areas. (See also W72-02474 thru W72-02487) (Davis-Chicago) W72-02473

URBAN WATER PLANNING AND MANAGEMENT: A CONCEPTUAL FRAMEWORK AND PROBLEM FOCUS,

Chicago University, Ill. Center for Urban Studies. J. R. Sheaffer.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 5-7.

Descriptors: Water resources, \*City planning, \*Planning, Methodology, \*Cities, \*Management hydrology, Multiple purpose, Environment, System

\*Water Identifiers: resources \*Metropolitan water resources management, Urban hydrology, Disjointed incrementalism, Participatory democracy, Metropolitan areas, Systems, Urban environment, Regional integration, Systems, Urban environment, Reg. Goals, Public-private involvement.

This paper attempts to present planning viewpoints toward urban hydrology. A frame of reference is established stressing current trends in planning. These include a common enemy approach stressing the distinction between the resource and liabilities, disjointed incrementalism, single purpose approaches and the emerging trend toward participatory democracy. The need to identify metropolitan water resource management as a specialized technical area was stressed. Six concepts implicit in metropolitan water resource management were outlined: multipurpose planning, multiple means, research relating to development of new alternatives, public-private involvement, water resource management seen as a part of the overall metropolitan planning effort, and regional integration. Finally, some practical approaches to implementation are discussed. Programs must reflect environmental reality; specifically, to reflect three basic principles: (1) the environment is a single system, (2) the earth, for planning purposes, is a closed system, and (3) storm water and pollutants are resources out of place. Metropolitan water resource management must be a means to an end.
It must be carefully related to community goals and aspirations. (See also W72-02473) (Davis-Chicago) W72-02474

BASIC NEEDS OF URBAN WATER MANAGE-MENT ON THE FIRING LINE.

Denver Water Dept., Colo. R. C. McWhinnie.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 8-13.

Descriptors: \*Water supply, \*Water management Descriptors: "Water supply, "Water management (Applied), "Cities, "Management, "Methodology, "Analytic techniques, "Planning, City planning, Water quality, Political aspects, Water policy, Water costs, Water demand, Water rates, Water requirements, Computer models, Social aspects, Evaluation, Feasibility studies, Economic efficiency Coordination Interacency concernion cy, Coordination, Inter-agency cooperation. Identifiers: \*Metropolitan water resources manage

ment, Interdisciplinary studies.

The basic need of the urban water manager is to develop a method of assessment of urban water needs in terms of location, quantity and quality and the associated costs, effects, and consequences. This includes: (1) identify the possible political frameworks for administering urban water s and the means to achieve the creation of those meworks; (2) provide a means to keep up to date with new ideas, concepts and rationale used to judge effectiveness of tested applications; (3) develop completely and substantiate the cause and effect of suggested specific actions and test before suggesting real world applications; (4) develop specific usable computer models applicable to planning and operations; (5) identify the environ-mental constraints and their costs in the real world; (6) evaluate the role of water in the socio-economic linkages that determine urban water policy; (7) identify the true cost of water and the levels of price elasticity and the effects; (8) identify the research needs, data required, and review periodically to keep pertinent; and (9) provide a means of coordinating all funding by state, and particularly federal levels into a comprehensive correlated package to best guide the use of resources. Several suggestions are offered to initiate solutions to at least some of the above problem areas: (a) regularly and periodically gather people of various disciplines together to discuss urban water problems and solutions; (b) follow-up attacks by joint-interest groups must be made on the major problems identified; (c) fund the problems of the real world on a basis of award that is open to review and criticism and (d) promote public awareness of urban water problems. (See also W72-02473) (Davis-Chicago)

URBAN RESOURCES MANAGEMENT DIMENSIONS

Department of Housing and Urban Development, Washington, D.C.

D. E. Jones.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 14-31. 10 fig, 3 ref.

Descriptors: Water resources, \*Management, \*City planning, \*Optimum development plans, \*Land use, Water resources development, Cities, Community development, Benefits, Planning, Methodology, Property values, Flood control, Floodproofing, Flood protection, Runoff. Identifiers: \*Metropolitan water resources manage-

ment, \*Dual drainage system, Regional planning, Urban resources, Open space, Flood losses, Land use controls, Municipal codes, Urban runoff.

A number of suggestions for improved urban water resources management are outlined. (1) The scope of urban and regional planning practice must be broadened to interrelate urban and natural resources planning when it is still practical to achieve optimum implementation of land and water resource development options. (2) Reorganization of traditional urban water resource management is necessary. (3) Enhancement of property values and environment by optimum development of land and water resources can produce significant economic benefits. (4)
Development of open spaces with ponds is consistent with enhancement objectives. (5) The adoption of the dual drainage system concept by a com-munity can produce significant drainage construction savings, better drainage service for the populace and reduced future need for flood control expenditures. (6) Optimum water resources management will recognize benefits to both upstream and downstream lands. (7) Urban runoff management can provide benefits, especially by downstream flood peak attentuation. (8) Street layout and grade designs can be used to route urban runoff. (9) Flood proofing offers some new dimensions for floodless limitation. (10) The exposure of building sites to a uniform probability of flooding risk will not assure uniformity of relative flooding losses. (11) The economic, ecologic and social wisdom of occupying flood prone sites must be considered in establishing land use controls. (12) Municipal codes have a significal potential for reducing flooding losses in occupied flood prone areas. (13) Emphasis should continue upon definition of inter-elationships between man and his water resources. (14) Today's suburb is tomorrow's city. (See also W72-02473) (Strachan-Chicago) W72-02476

WATER MANAGEMENT AND THE PUBLIC,

Colorado State Univ., Fort Collins. Dept. of Politi-

D. W. Hill, and R. L. Meek.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research. July 27-31, 1970, Deerfield, Massachusetts, p 43-

Descriptors: Water resources, \*Management, \*Political constraints, \*Political aspects, \*Decision making, Water policy, Governments, Administra tion, Psychological aspects, Social aspects, Social values, Attitudes, Social needs, Communication. Identifiers: \*Water management systems, \*Public support, Water competency, Water efficacy, Peer input, Water saliency, Colorado.

This paper attempts to characterize water management systems and determine how they are con-strained by their publics, based on a comparative and their publics in water agencies and their publics Colorado. Initially, it was obvious that the public has a generally low visibility of water and water management issues. Also, members of the public management issue political decision-making systems in water, whether public or private. Several variables were identified which showed a high potential for constraining water systems: 'water competency,' a measure of an individual's ability to ess the ramifications of the specialized functions of decision-making in the management of water; 'water efficacy,' a measure of the sense of effectiveness a person feels he can assert in the water policy and decision-making arena; 'peer input,' the amount of discussion the person perceives himself having with peers; and 'water saliency,' a measure of the extent to which water is salient and visible to a person as an issue with high priority in his scale of values. The higher the public perception of the quality needed to manage and make decisions, the blacker or dimmer the characterization of management. As contact with management increases it appears that the general image of the character and quality of management worsens, but the assessment of management's response grows more favorable. It of management's response grows more avorance, in appears that a good image of ones competence, skill, and quality as a manager and the quality and effectiveness of his organization probably do not provide a manager with an adequate basis for public support and security in his functions. The quality of response and the facility to perceive needs and meet them are a more secure base upon which to proceed. (See also W72-02473) (Davis-Chicago) W72-02477

URBAN WATER MANAGEMENT NEEDS IN RUNOFF AND FLOOD REGULATION. Georgia Inst. of Tech., Atlanta. Dept. of Civil En-

gineering. J. R. Wallace.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 32-

Descriptors: Water resources, \*Runoff, \*Flood control, \*Cities, City planning, Urbanization, Technology, Social aspects, Engineering, Opera-

identifiers: \*Metropolitan water resources manage-ment, \*Urban runoff, \*Flood regulation, Interdisciplinary research.

Several observations on research needs and the present state of affairs in urban runoff and flood

### Field 06-WATER RESOURCES PLANNING

#### **Group 6B—Evaluation Process**

regulation are made. (1) Interdisciplinary research is essential, but very expensive and very difficult.
(2) In some jurisdictions technical knowledge does not, and possible, cannot, play a major role. (3) So-cial research must receive high priority. (4) There is a strong need to learn more about limitations and is a strong need to learn more about limitations and needs of engineering at local levels - who is doing the work and how. (5) What improvements in technical knowledge can be utilized. (6) How can existing technical knowledge be incorporated into everyday operations. (See also W72-02473) (Davis-Chicago)
W72-02478

INTEGRATED MANAGEMENT OF METROPOLITAN WATER SERVICES, New York State Dept. of Environmental Conservation, Albany. Div. of Water Research. E. L. Vopelak. In: Urban Water Conservation of the Conservation of t

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 36-

Descriptors: \*Management, \*Water supply, \*Cities, Water resources, \*Groundwater, City planning, Water districts, Utilities, Waste water treatment, Sewage treatment, Storm runoff, Urbanization, Community development, Political

Identifiers: \*Metropolitan water resources management, \*Integrated management, Waste water management, New York Metropolitan area, Groundwater depletion, Groundwater contamination, Public support.

Integration of metropolitan water service is defined in two ways: the intergration of all water supplies in a metropolitan complex as well as multipurpose development of the sources insofar as practicable; and the integration of water supply, sewage, storm water drainage, etc., within a highly developed area. The New York Metropolitan Area, is used as an example, specifically, the problem of ground water depletion and contamination on Long Island. It is concluded that for integrated management of metropolitan water services to be effective, the in-fluential public factions must be involved and made aware of the consequences resulting from avoiding sound integrated management practices. A method must be developed to provide feedback from the public support, it is doubtful that the concept of integrated management could be successfully implemented. (See also W72-02473) (Davis-Chicago) W72-02479

SOME NOTES ON APPROACHES AND VIEW-POINTS OF PRIVATE AGENCIES TO METROPOLITAN WATER MANAGEMENT, Reitz and Jens, Inc., St. Louis, Mo.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 47-

Descriptors: Water resources, \*Management, \*Ci-\*Water utilization, Flood control, supply, Hydroelectric power, Navigation, Recrea-tion, Low-flow, Water reuse, Air conditioning, Public utilities, Public utilities, Puticulities, Attitudes, Identifiers: \*Metropolitan water resources management, \*Private agencies, Low-flow regulation.

The role of private agencies in the management of urban water resources is approached by examining several areas of water use: Water supply, self-supseveral areas of water use: water supply, sen-sup-plied industrial water supply, air-conditioning, hydroelectric power, flood control, navigation, recreation, low-flow regulation, and water re-use. From this it was concluded that in urban water resources use or management, self interest remains more directly and clearly the cominant stimulus for private individuals, companies or agencies, than for publicly selected or governmental agencies. The attitudes and approaches of private managers of urban water resources have the advantages of the

pressures and incentives of a competitive society (present to some degree even in the regulated monopolies such as public water supply under private ownership); they have the disadvantages in the opportunity for irresponsible or dishonest ex-ploitation (although even these qualities have some checks and restraints in the long run). Apparently the lack of economic pressure and consequent lessening of incentive, make some public, governmental water managers less efficient. (See also W72-02473) (Davis-Chicago)

SOME CHALLENGES POSED BY TRADI-TIONAL INSTITUTIONS AND PRACTICES, Georgia Inst. of Tech., Atlanta. Environmental

Resources Center. G. G. Willeke.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 61-

Descriptors: \*Planning, \*Institutions, \*Institutional constraints, Social values, Organizations, Communication, Decision making, Engineering personnel, Governments, Social aspects.

Identifiers: \*Traditional institutions, Heirarchal Officerioristics.

ganizations, Engineer-client relationship, ASCE code of ethics, Public involvement, Metropolitan water resources management, Institutional grants.

An institution is defined as a collection of values expressed by particular people involved in doing something. A number of traditional institutions need to be changed: (1) heirarchial organizations suffer from insufficient opportunity for job satisfaction, problems of communication and decision making, and are too rigid to adapt to new situa-tions. A change to a more adaptive, free-form organization is desirable; (2) the engineer-client relationship which tends to be limited to a small segment of the total problem, suffers from a fee structure which discourages a search for alternatives, and doesn't allow for an adequate study budget; (3) the ASCE code of ethics which does not allow for and encourage sufficient input by engineers to public decision; (4) personal contacts between en-gineers and their clients tend to be brief and inadequate for dealing with complex problems; (5) public involvement in planning does not occur with sufficient frequency or intensity to be useful or appropriate; (6) governmental institutions need to be improved especially at the state and local levels, to be able to cope with the demands placed on them; and the way engineers look at themselves needs to be broadened to include non-technical matters as well. Several things that need further understanding on the part of engineers are outlined: (a) differ-ing terminology within the broad area of metropolitan water resources management needs to be clarified; (b) university people and practicing professionals need to appreciate each others problems; (c) the dissemination of information needs to be improved; and (d) more effective use of institutional grants. (See also W72-02473) (Davis-Chicago) W72-02481

ROLE AND FUNCTION OF SYSTEMS ANALY-

SIS, Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering. J. C. Schaake.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 72-

Descriptors: \*Systems analysis, \*Methodology, \*Analytic techniques, \*Planning, \*Mathematical models, Computer models, Model studies, Operations research.

Several approaches to the solution of complex problems are identified. One is to seek the most significant aspect of a complex problem and then

characterize the problem in terms of the most sig-nificant feature. Another is to try to decompose the problem into a number of independent parts. Both of these techniques require assumptions to be made about the states of parts of the system other than those being considered. A third approach is to seek an analogy between the problem under considera-tion and some other analogous situation. The analogy then provides a framework for thinking about the problem. A common form of analogy is the one which exists between the symbolic world of mathematics and logic and the real world in which problems really occur. Such analogies are often referred to as mathematical models. Such models form the framework for the use of digital compu-ters and systems analysis. (See also W72-02473) (Davis-Chicago) W72-02482

AN OVERVIEW OF CONTEMPORARY AP-PROACHES AND CONCEPTS
METROPOLITAN WATER MANAGEMENT, Office of Water Resources Research, Washington, DC

G. F. Mangan. In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 75-

Descriptors: Water resources, \*Management, \*Cities, \*Planning, Water policy, Formulation, Administration, Forecasting, Institutions, Social

Identifiers: \*Metropolitan water resources manage-ment, \*Policy, Authority, Public-private responsi-

Urban water management is divided into two levels: the formulative, concerned with establishing levels: the formulative, concerned with establishing overall goals and arriving at policies for their attainment; and the administrative, concerned with forecasting future needs, making plans for meeting forecasts, mobilizing resources to carry out the plans, and actually supervising or operating the means or facilities developed. Each level has unique characteristics, but also common characteristics; i.e. fragmentation of responsibility and teristics, i.e., fragmentation of responsibility and authority, and a mix of private and public responsi bility and authority. It is contended that fragmentation is not necessarily undesirable although there appears to be a trend toward consolidation of responsibility and authority. For the future, it is obvious that new policies and administrative institutions must evolve in response to society's changing aspirations and urban water needs within a context of the larger communal purpose. (See also W72-02473) (Davis-Chicago)

INTEGRATING THE PLANNING AND MANAGEMENT OF METROPOLITAN WATER RESOURCES INTO A REGIONAL CONTEXT, National Water Commission, Arlington, Va. A. B. Bigler.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 81-99. 5 fig, 9 ref.

Descriptors: \*Planning, \*Management, \*City planning, Water resources, Organizations, Urbanization, Cities, Decision making, Institutions, Environment, Analytic techniques, Optimization, Resource development, Attitudes, Social values, Social needs, Model studies, Systems analysis, Ecology, Social aspects.

Ecology, social aspects. Identifiers: \*Integrated planning, \*Metropolitan water resources management, \*Comprehensive planning, \*Regional planning, Implementation, Metropolitan areas, Ecosystem context.

Integration of metropolitan water resources planning and management into a regional context involves three conditions: (1) the achievement of an effective metropolitan water planning and management system, and one which is integrated

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#### WATER RESOURCES PLANNING-Field 06

#### Evaluation Process—Group 6B

with comprehensive metropolitan development; (2) the existence of a viable regional water resource planning and management organization designed to be responsive to metropolitan needs and the other institutional, environmental, and developmental characteristics of the region; and (3) the design and implementation of appropriate linkages for integrating water planning manage-ment between the metropolitan area and the region into a unified system. Practicing decision makers must have advanced planning and management techniques which will: (a) provide a comprehen-sive approach accommodating the wide range of elements involved in such water management systems; (b) provide a means to derive optimum planning relationships between goals and objectives, means, social values and attitudes, and physical limitations; and (c) provide a mechanism with which to relate an integrated metropolitan-regional water management process to the overall growth and development of the region and metropolitan area. Several systems analysis approaches are currently being used as advanced management techniques: economic optimization models, regional analysis, and the ecosystem context. The paper also includes review of a number of the latest normative statements on the nature of metropolitan water resource management. (See also W72-02473) (Davis-Chicago) W72-02484

APPROACHES AND VIEWPOINTS OF STATE NATURAL WATER RESOURCES AGENCIES, Rutgers-The State Univ., New Brunswick, N.J. Water Resources Research Inst. W. Whipple.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 100-

Descriptors: \*State governments, Water resources, \*Institutions, \*Federal government, \*Social aspects, \*Political aspects, Cities, Navigation, Environment, Ecology, Flood control, Hydro-electric power, Water quality control, Attitudes, Planning, Water policy.
Identifiers: \*State agencies, Interstate problems,

Technical competence.

How the states are affected by the main groups of water resources functions is discussed in detail. These groups include: federal construction programs (navigation, structural flood control, hydroelectric power, and irrigation), water supply, environment and ecology, water quality control, and the general attitudes of the states towards federal action. It is concluded that the general predominance of the Federal government in water resources matters has come from five sources: the generally greater technical ability of the Federal staffs, the inherent ability of the Federal agencies to handle inter-state problems, the practical effect of Federal program financing in superseding state programs in the same field, the general support of intellectuals, and the recently increasing power of the cities, which turn increasingly towards direct Federal support. Despite these strong influences, the states and their agencies have not only continued in existence, but have increased in size, influence, and technical ability. Among the in-fluences which have strengthened them are the increasing public concern with the environment and the complex involvement of the water pollution control field with the economic, physical and institutional functioning of our society. The Federal agencies' force and abilities are sufficient to gain the initiative in policy and in planning and to retain the status quo for the older construction programs; but pollution control is so intimately involved with peoples' lives and local activities that the state and its agencies seem likely to play a large role for the immediate future. (See also W72-02473) (Davis-Chicago) W72-02485

NATURE OF AND NEED FOR INTERDISCIPLI-NARY ATTACKS ON PROBLEMS OF URBAN WATER MANAGEMENT, Colorado Univ., Boulder. Center for Urban En-gineering Studies. J. E. Flack.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 106-110.

Descriptors: Water resources, \*Management, \*City planning, \*Methodology, Planning, Cities, Social aspects, Political aspects, Priorities, Water supply, Sewage disposal, Decision making, Atdes, Environment, Systems analysis,

Identifiers: \*Metropolitan water resources management, \*Urban areas, \*Interdisciplinary research, Environmental problems, Physical subsystem, Perceptions, Non-technologic aspects, hearings.

The urban area can be visualized as a total system consisting of three interrelated parts: (1) the social subsystem, (2) the physical subsystem, and (3) the political subsystem. Little is known about the linkages between these subsystems, yet these linkages are a keystone to successful management of the water resources of urban areas. A basic need is a methodology for integrating the non-technologic aspects of urban water with the more utilitarian functions of water supply and sewage disposal. A key part of resolving this need is the application of survey research to determine attitudes and perceptions of decision makers, influentials and th cerned publics toward various physical and environmental problems. Such research will aid in establishing priorities for accomplishment of tasks in urban engineering since the determination of community goals and priorities with regard to the water resource requires much more than the historic public hearing technique. It is apparent that the need for interdisciplinary research into the behavioral-technological interface in urban water management is both timely and urgent. The development of new techniques of planning and major new procedures for determining objectives of urban water management make such research imperative. (See also W72-02473) (Davis-Chicago) W72-02486

REGIONAL WATER RESOURCES PLANNING: A STATE VIEW, Minnesota Water Resources Planning and Basin

Coordination, St. Paul.

G. J. Kelnhofer.

In: Urban Water Resources Management - 3rd Conference on Urban Water Resources Research, July 27-31, 1970, Deerfield, Massachusetts, p 111-119.

Descriptors: \*River basin commissions, \*Planning, \*Coordination, \*Inter-agency cooperation, \*Institutional constraints, Federal government, State governments, Decision making, Financing, Water resources, Water resources development.

Identifiers: \*Institutional efficiency, Citizen groups, Public participation.

Several problems are identified which make it difficult for the various river basin commissions to perform effectively. (1) The Federal partner tends to dominate the work of the commissions, and most state participation is not at an adequate level. (2) The commission chairman and his staff have insufficient control over the personnel charged with the responsibility for plan preparation, making it difficult to fix responsibility for the pace and quality of the commission's work. (3) An inordinate amount of time and money is spent in the preparation of voluminous planning reports of questiona-ble utility. (4) The role of citizen groups and local governments in defining problems and evaluating alternative solutions is still uncertain. (5) The public visibility of the commissions is quite low. An alternate organization is suggested, consisting of a

river basin management organization created and funded jointly by the states and the Federal Government. Direction of the agency would rest with a board of directors made up of the elected representatives of local governments, and officials of the state and Federal governments. Financing would be shared among all three governments, with the local government's portion of the budget coming from a tax levied on all the counties in the basin. The management agency would have complete authority to plan, design, build and operate any water resources development project called for in its adopted plans. (See also W72-02473) (Davis-Chicago) W72-02487

ARTIFICIAL LAKES AND LAND SUBDIVI-

For primary bibliographic entry see Field 06E. W72-02489

WATER RESOURCES PLANNING ACT. For primary bibliographic entry see Field 06E. W72-02495

THE 'NEW' ENVIRONMENTALISM: AN IN-TELLECTUAL FRONTIER, Rutgers-The State Univ., Rutgers, N. J. For primary bibliographic entry see Field 06G. W72-02592

LAND USE ALONG THE LAKE MICHIGAN

SHORE. State of Illinois, Lake Michigan and Adjoining Land Study Commission.

In: Report to the Governor and the 77th General Assembly, Vol II - Supporting Studies, October 1971, p 163-181, 6 tab, 7 ref.

Descriptors: \*Land use, \*Lake Michigan, \*Recreation, \*Aesthetics, \*Priorities, \*Shores, Recreation demand, Recreation facilities, Beaches, Access routes, Community development, Planning, Resource development, Identifiers: \*Lakefront land use, \*Public usage,

Public open space, Chicago metropolitan area.

Existing lakefront land usage, existing recreational capacities, projected demands upon the lakefront, current plans for new lakefront development, and specific recommendations designed to enhance the ake Michigan shoreland within Illinois as an area of pre-eminent public usage is described in detail. The recommendations include: (1) the highest priority for land use should be given to increasing the amount of public open space along the lakefront;
(2) lakefront open space and beach areas should be developed to accommodate anticipated recreational demands; (3) lakefront land not devoted to open space should be restricted to uses compatible with the open space usage of neighboring areas; (4) maximum physical access to Lake Michigan should be afforded to the broadest possible range of persons and unreasonable obstructions to the public's view of the lake should be prohibited; and (5) a thorough review and evaluation must be un-dertaken of all proposed projects which might af-fect the lakefront. (Davis-Chicago) W72-02595

SEWAGE DISPOSAL IN CHICAGO, PAST DECISIONS AND FUTURE PROSPECTS. State of Illinois, Lake Michigan and Adjoining Land Study Commission.

In: Report to the Governor and the 77th General Assembly, Vol II - Supporting Studies, October 1971, p 113-124. 17 ref.

Descriptors: \*Decision making, \*Sewage treatment, \*Sewage disposal, \*Wastewater treatment, \*Lake Michigan, \*Planning, Wastewater disposal, Pollution, Water policy.

#### Field 06—WATER RESOURCES PLANNING

### **Group 6B—Evaluation Process**

Identifiers: \*Chicago metropolitan area, Chicago sanitary canal, Illinois river.

Many of the current environmental problems can Many of the current environmental problems can be attributed to the poor planning and narrow perspectives of prior generations. This can be illustrated by a historical review of the successive technologies utilized for sewage treatment and disposal in the Chicago metropolitan area. Crucial disposal in the Chicago metropolitan area. Crucial decisions in the past are examined and evaluated, forming the basis for suggestions regarding future changes in sewage treatment philosophy and technology. The past focuses upon the decision to convey most of the wastewater of the Chicago metropolitan area down the Chicago Sanitary Canal into the Illinois River system to prevent pollution of Lake Michigan, the area's primary water supply source. Since that time it has proved necessary to adopt wastewater treatment instead of merely utilizing the assimilative capacity of the IIlinois River. However, this policy is also becoming inadequate. The big question at this point is whether to continue with the same basic policy by improving the water treatment process, or to develop a totally different approach, e.g. applica-tion of sewage effluent to the land. (Davis-Chicago) W72-02598

# APPENDIX F - FLOW-STORAGE RELATION-SHIPS AND THE COST OF FLOW,

New Mexico Univ., Albuquerque.
N. Wollman, and G. W. Bonem.
In: The Outlook for Water, The Johns Hopkins
Press, Baltimore, 1971, p 244-279. 1 fig, 18 tab, 21

Descriptors: \*Water resources development, \*Flow, \*Storage, \*Costs, \*Water supply, Reser-

Identifiers: \*Relationships, \*Cost of flow, \*Maximum supply of water, Losses, Physiographic, Per-

Within this study, the phrase 'supply of water' refers to several different measurements. 'Supply of water' occasionally refers to the flow-duration curve, i.e., the percentage of time that flows of a designated amount are equaled or exceeded. 'Maximum supply' refers to the mean annual flow adjusted for evaporation from additional storage reservoirs. 'Cost of flow' refers to the cost of additional reservoir capacity needed to raise present minimum flows to successively higher levels up to the mean annual flow net of additional reservoir evaporation. Costs of flow are expressed as capital cost, annual equivalent cost for marginal or average cost per unit of regulated flow, or as cumulative total cost for a specified level of regulated flow. Some of the aspects considered in the tables include: storage required to produce gross flows equal to indicated percentages of mean annual flow (MAF), with 98%, (%%, and 90% availability and no deduction for reservoir losses, by region; capital costs of storage capacity per acre-foot, by physiographic zone and size class, 1964 prices; capacity of reservoirs in thousands of acre-feet, existing or under construction in 1964; distribution of existing reservoirs by size class; synthetic schedule of reservoirs; percentage of total new capacity in each region assigned to various size classes; synthetic storage schedules, by region; and synthetic schedules of flow, storage, and costs, by region: 90% availability, 0.0425 annual factor. (Strachan-Chicago) W72-02601

# APPENDIX E - ESTIMATION OF WASTE LOADS AND TREATMENT COSTS,

New Mexico Univ., Albuquerque. N. Wollman, and G. W. Bonem.

In: The Outlook for Water, The Johns Hopkins Press, Baltimore, 1971, p 221-243. 27 tab, 8 ref.

Descriptors: \*Waste treatment, \*Estimated costs, Statistics, Biochemical oxygen demand, Thermal pollution, Municipal wastes, Industrial wastes, Recirculated water, Hydro-electric power, Rates, Identifiers: \*Waste loads, \*Treatment costs, Ther-mal waste loads, Standard treatment.

Statistics are presented for estimation of biochemical oxygen demand (BOD) waste loads, thermal waste loads, waste treatment costs (including in-dustrial waste treatment and municipal waste treatment costs, recirculation costs, and short-term treatment costs). Some of the aspects of waste loads and treatment costs which are considered in the tables include: costs of standard treatment by level of treatment and region for 1960, 1980 low-medium-high, and 2000 low-medium-high; recirculation rates required to offset thermal waste loads in selected regions; thermal waste loads: cooling water discharge, by industry and region for 1960, 1980 medium, 2000 medium, and 2020 medium; and costs of recirculation, steam-electric power for 1960, 1980 medium, 2000 medium, 2020 medium, 2020 high, for both original and revised rates. (Strachan-Chicago)

## APPENDIX D - TREATMENT, DILUTION, AND TREATMENT COSTS OF MUNICIPAL AND IN-DUSTRIAL WASTES,

DUSTRIAL WASTES, Oklahoma Univ., Norman. G. W. Reid, W. W. Eckenfelder, L. E. Streebin, R. Y. Nelson, and O. T. Love, Jr. In: The Outlook for Water, The Johns Hopkins Press, Baltimore, 1971, p 203-220. 2 fig, 15 tab, 8

Descriptors: \*Waste water treatment, \*Municipal wastes, \*Industrial wastes, \*Model studies, \*Economics, \*Water quality, \*Standards, Thermal pollution, Equations.

pointion, Equations. Identifiers: \*Dilution, \*Treatment costs, \*Projections, \*Physical stream characteristics, \*Instream, Short-term treatment, Committee Print No 29, Figures, Tables.

Appendix D presents equations, figures, and tables which explicate aspects of the treatment, dilution, and treatment costs of municipal and industrial wastes. The models used are on a regional scale. The problem is as follows: given aggregate economic projections, physical stream characteristics, and instream water quality standards, to develop dilution water requirements as a function of municipal and industrial waste treatment levels. The results of this study are compared with Committee Print No 29 (Reid, G. W., 'Water Requirements for Pollution Abatement', Senate Select Committee on National Water Resources, 86th Cong., 2nd sess.), which also dealt with this problem. Additionally, this study has incorporated the following ideas: effects of short-term treatment, the effects of location and scale on treatment costs, and thermal pollution. As previously, the basic loadings and stream characteristics were obtained from other workers, the intention of this present study being the development of basic models, unit loadings and costs of treatment. (Strachan-Chicago) W72-02603

#### APPENDIX A - BASIC ECONOMIC PROJEC-TIONS,

New Mexico Univ., Albuquerque. N. Wollman, and G. W. Bonem. In: The Outlook for Water, The Johns Hopkins Press, Baltimore, 1971, p 155-173. 1 fig, 23 tab, 33

Descriptors: \*Water resources development, Descriptors: "water resources development, \*Economics, \*Population, \*Gross national product, Irrigation, Mining, Hydroelectric power, Productivity, Industries. Identifiers: \*Projections, \*Economic activity, Urban population, Manufacturing, Labor force, Water resource region.

Projections are made for population and the gross national product. The general nature of the projected regional pattern of population is as follows: the Northeast and North Central proportion of the U.S. population is projected to decline from 54 percent in 1960 to 47 percent in 2020, while the West is projected to grow from about 15 percent in 1960 to 21 percent in 2020. The main projection for population shift is from East to West, a movement from generally humid areas to arid, or less humid areas. A subdivision in this topic, urban population, is also projected. Projections of the gross national product were obtained by projecting the size of the labor force and then applying rates of productivity increase. Projections for irrigated acreage, mining output (bituminous coal, copper ore, iron ore, phosphate rock, sand and gravel, crude petroleum, natural gas, natural gas liquids), manufacturing, and steam-electric power. This study is also compared with other projections of economic activity of individual water resource regions: New England, Chesapeake Bay, Ohio, Eastern Great Lakes, Cumberland and Tennessee, Upper Missouri, Western Gulf, and Pacific Northwest. It was attempted to ascertain whether the projections of population were consistent with the economic base represented by the industrial projections. No answer was obtained, because the industrial projections. tions represented only a small amount of the total employment. (Strachan-Chicago) W72-02605

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# CHAPTER XII - VARIATIONS IN SELECTED

PARAMETERS, New Mexico Univ., Albuquerque. For primary bibliographic entry see Field 06A. W72-02606

# CHAPTER X - THE BASIC MODEL: THE

New Mexico Univ., Albuquerque. For primary bibliographic entry see Field 05G. W72-02608

# CHAPTER IX - THE 'SUPPLY' OF WATER AND

COSTS OF FLOW, New Mexico Univ., Albuquerque. For primary bibliographic entry see Field 04A. W72-02609

#### CHAPTER VI - COEFFICIENTS OF WATER USE: WITHDRAWAL USES,

New Mexico Univ., Albuquerque. N. Wollman, and G. W. Bonem.

In: The Outlook for Water, The Johns Hopkins Press, Baltimore, 1971, p 48-54. 7 tab, 13 ref.

Descriptors: \*Withdrawal, \*Water utilization, \*Intakes, \*Flow, Agriculture, Mining, Hydroelectric power, Municipal water, Evaluation, Evaporation, ranspiration.

Identifiers: \*Water use, \*Withdrawal uses, \*Intake, \*Onsite, 'Flow-through', Manufacturing.

Three categories of water use are distinguished (the first two contributing to evaporation and transpiration losses): (1) withdrawal (or intake), (2) onsite, and (3) flow. Onsite uses and waste dilution flow will be discussed in later chapters. Withdrawal uses are defined as those that involve movement of water from a natural water course or lake into a man-made hydraulic system, for example, irrigation ditches. All withdrawal uses require a larger 'flow-through' than is lost to the atmosphere, or incorporated into the product. Flow-through will exceed intake if water is recirculated within a given hydraulic system. Otherwise flow-through and in-take are equal. Withdrawal uses are discussed in terms of agriculture, mining, manufacturing, steam-electric power, and municipalities. Seven tables are presented and discussed to illuminate evaluation of withdrawal uses within these areas. (Strachan-Chicago) W72-02612

#### WATER RESOURCES PLANNING—Field 06

#### **Evaluation Process—Group 6B**

CHAPTER V - POLULATION AND ECONOMIC ACTIVITY PROJECTIONS TO THE YEAR 2020.

2020, New Mexico Univ., Albuquerque.
N. Wollman, and G. W. Bonem.
In: The Outlook for Water, The Johns Hopkins Press, Baltimore. 1971. p 41-47. 8 tab, 11 ref. OWRR B-007-N MEX (2).

Descriptors: \*Population, \*Economics, \*Hydroelectric power, \*Mining, \*Livestock, \*Irrigation, Water requirements, Gross national product, Industries, Agriculture, Soil moisture, Conservation. Identifiers: \*Projections, \*Economic activity, \*Manufacturing, Urban population, Water use.

Tables of population, manufacturing output, power generated by steam-electric plants, mining output, livestock production, and irrigated acreage are presented and discussed. The principal determinants of water use are population and the level and pattern of economic activity, population having the more direct relationship with water requirements. The United States population might double between 1960 and 2000 but probably will grow by a somewhat smaller amount. Urban population will grow more rapidly than total population but less rapidly than population in major urban centers.

The gross national product, at Medium rates of change in population, labor force participation, and productivity per worker, is projected to grow to eight times the 1960 level by the year 2020. Five industries were projected through a sequence of steps involving separate determinations of value added, water use, and water-borne waste residual coefficients. Each industry's output was distributed among regions in accordance with the percentage distribution used in projections prepared for the Senate Select Committee. Similar steps were made for mining and electric power. Agricultural water use consists of domestic uses, stock watering, and irrigation, the latter being the major water use in the United States, whether it is measured by intake or by loss to the atmosphere. Soil and moisture conservation activities were treated as a separate category in the study, and hence, a category which is independent of population and economic activi-ty. (Strachan-Chicago) W72-02613

### CHAPTER IV - CONCLUSIONS, POLICY IS-SUES, AND RESEARCH PRIORITIES, New Mexico Univ., Albuquerque.

G. W. Bonem.

In: The Outlook for Water, The Johns Hopkins Press, Baltimore. 1971. p 32-37. 5 ref. OWRR B-007-N MEX (2).

Descriptors: \*Water resources development, \*Environment, \*Quality control, \*Planning, \*Research and development, Water quality control, Water quality, Water shortage, Planning, Decision mak-

Identifiers: \*Policy-making, \*Research needs, Water quantity, Southwest region, Upper Arkan-sas-White-Red region.

The conclusions of the study are summarized. (1) The conclusions of previous studies that degradation of water quality and the related enviro pose a basic threat to well-being are reconfirmed. At the same time, the study also indicates that a serious physical limitation will prevent the achievement of a high-quality water environment - e.g., 6 mg/l of dissolved oxygen. (2) Over the next halfcentury the Southwest will continue as the nation's hard-core area of absolute water shortage, with the Upper Arkansas-White-Red region joining this classification later. (3) Within a national perspec-tive, problems of water quality will be more insur-mountable than those of water quantity. Several policy-making considerations are indicated: the value of high growth, artificial lakes versus undisturbed flow, cost allocation, deficiency risks, standards of quality, and aesthetic values. Areas of urgent research needs are delineated: treatment of dissolved solids, interbasin transfers, waste collection and thermal pollution, waste treatment versus water treatment, inputs per unit of output, regional data and analysis, and the price elasticity of water. (Strachan-Chicago) (Strachan-Cl W72-02614

THE OUTLOOK FOR WATER, New Mexico Univ., Albuquerque. For primary bibliographic entry see Field 06A. W72-02615

#### CHAPTER I - THE PROBLEM AND THE AP-PROACH,

New Mexico Univ., Albuquerque. N. Wollman, and G. W. Bonem. In: The Outlook for Water, The Johns Hopkins Press, Baltimore. 1971. p 3-5. 1 ref. OWRR B-007-N MEX (2).

Descriptors: \*Water resources development, \*Resources, \*Future planning (Projected), \*Economics, Water supply, Water quality, Regional analysis, Supply, Demand. Identifiers: \*Comprehensive projections, \*Systematic economic model, Water quantity, National

The need for well-grounded projections of future supplies and requirements is as great for water as for any other natural resource. However, the art of making comprehensive projections for the water resource remains notably undeveloped in contrast to projections made for major metals and mineral fuels. The authors attribute this problem to the unique and elusive characteristics of water as a natural resource. (1) Most water problems are local or regional rather than national. (2) There is no true market for water. (3) Water from the same source is used for many different purposes, and the various uses affect the supply in many different ways. (4) The very close relationship between quality and quantity is often of little value as a measure of water supply. (5) There are few absolute requirements for establishing either quality or quantity. (6) Once agreement has been reached on quantity. (6) Once agreement has been reached on the desired level of quality and the amount of dependability of flow, there are widely different ways of achieving these aims. The authors outline the ultimate goals of their study. The study seeks to develop a systematic economic model that: (1) recognizes the regional aspects of the water problem yet yields a national perspective, (2) permits aggregation of demand and supply into usefully parallel concepts, (3) takes into account the fugitive and probabilistic characteristics of supply as well as the interdependence between supply and demand, and (4) identifies important choices to be demand, and (4) definities important choices to be made and tensions to expect within and among water resource regions. One purpose of the study is to make explicit how aesthetic judgments can be in-corporated into the body of an economic analysis of water resources. (Strachan-Chicago) W72-02616

# CHAPTER III - A SUMMARY OF THE

New Mexico Univ., Albuquerque. N. Wollman, and G. W. Bonem.

In: The Outlook for Water, The Johns Hopkins Press, Baltimore. 1971. p 18-31. 2 tab, 15 ref. OWRR B-007-N MEX (2).

Descriptors: \*Water resources development, \*Environment, \*Management, Water storage, Water treatment, Water shortage, Sewerage, Thermal pol-

Identifiers: \*The Upper Missouri and Western Great Lakes regions, Heat pollution.

The results of the study are presented. They are not intended to represent predictions nor full-scale projections, but instead, demonstrate the problems which will occur if certain trends of water use continue. Greatest attention is given to the basic model and to Medium projections of economic growth. In comparing this study to a previous Committee report (Print no 32) in terms of equivalent programs and projections, seven basic differences in results are enumerated. (1) New storage is less and the amount spent on new storage falls even more. (2) Treatment costs in the aggregate are less because of lower unit costs of treatment. (3) Water shortens in less ware though available. shortage is less even though maximum net regu-lated flow is less, because of reductions in water required for swamps and wetlands and steam-electric power. (4) The Upper Missouri and Western Great Lakes regions, which were projected as being water-short by 2000 Medium, are not now projected as water-short regions until higher levels of population and economic activity are attained. (5) The costs of sewerage are estimated at a substantially higher rate. (6) Thermal pollution, ignored in the previous study, is likely to pose a major problem in the future. (7) Costs of recirculation needed to avoid heat pollution by steam-electric power plants promise to be a major part of the fu-ture costs of maintaining stream quality. (Strachan-Chicago) W72-02617

# RESOURCE INVESTMENTS, IMPACT DIS-TRIBUTION, AND EVALUATION CONCEPTS, Cornell Univ., Ithaca, N.Y. For primary bibliographic entry see Field 06A.

W72-02641

#### CRITERIA OF ECONOMIC EVALUATION IN WATER RESOURCES DEVELOPMENT.

United Nations Office of Technical Cooperation, The Working Group of Experts on Water Resources Planning, August 29-September 9, 1968, Bangkok, Thailand, p 71-80. Planning Water Resources Development. Water Resources Series

Descriptors: \*Water resources development, \*Evaluation, \*Economic efficiency, \*Cost-benefit ratio, \*National income.

Identifiers: \*Income redistribution, \*Rate of effectiveness, Internal rate of return, Minimum cost, Economic welfare, Developing countries.

Criteria used in evaluating the effectiveness and efficiency of water resources projects in attaining national economic goals are enumerated. The maximization of economic efficiency (or maximum economic welfare with available resources) is the criterion most frequently used in water resources project evaluation. The basis for economic efficiency are criteria such as the benefit-cost ratio, internal rate of return, rate of effectiveness and minimum cost. An equation relates the benefit-cost ratio to the total present worth of annual benefits and project costs. The rate of effectiveness, used in the Soviet Union, is a ratio between savings of annual current expenditures and incremental investment in the comparison of the project with its alternatives. The minimum cost criterion is widely adopted in selecting the best alternative layout and construction method but is not generally applicable to water resources projects. The advantages, disadvantages, and areas of applications of these criteria for developing countries are compared. The criterion for maximizing national income may not be the same as that for maximizing national economic welfare. Internal inequities are increasing for the developing countries and the trend of income redistribution needs to be taken into con-sideration. (Haugh-Wisconsin) W72-02644

# AN INFORMATION SYSTEM FOR IMPROVING THE EVALUATION OF NONMARKETED OUT-

PUTS, Army Engineer Inst. for Water Resources, Alexandria, Va.

U.S. Army Engineer Institute for Water Resources Report 71-5, July, 1971. 46 p, 10 ref, 1 append.

### Field 06-WATER RESOURCES PLANNING

### Group 6B—Evaluation Process

escriptors: \*Water resources development, \*Project planning, \*Cost-benefit analysis, \*Intangible benefits, Decision making, Investment, Social

Identifiers: Information, Public participation, Environmental values, Nonmarket outputs.

The multiplicity of objectives served by water resources investments makes the determination of benefits and costs extremely difficult, particularly when it is impossible to state all benefits in terms of a common unit of account. In an effort to make cost-benefit analysis more meaningful, an approach to evaluating noncommensurate outputs is developed, primarily by combining concepts taken from Margolis, McKean, and Lord. The approach is divided into two main phases: (1) the conception phase in which the project planner attempts to discern the emphasis the public would like to have placed on nondollar-valued outputs relative to dol-lar-valued outputs, and (2) the public participation phase in which interested citizens are given the opportunity to express their feelings regarding the suitability of the alternatives presented by the planners. Two important initial steps can be taken to provide a foundation for organizing and implementing this evaluation approach: (1) provide more and better information for all levels of decision-making, and (2) provide for the systematic submission and review of information displays throughout the planning process. An information system to support this approach to evaluating non-marketed outputs is also considered. (Settle-Wisconsin) W72-02645

ZERO POLLUTION: A TRADEOFF ANALYSIS, Boston Univ., Mass. For primary bibliographic entry see Field 06A.

W72-02646

INTEGRATION OF WATER RESOURCES PLANS WITH NATIONAL ECONOMIC DEVELOPMENT AND PLANNING.

United Nations Asian Institute for Economic Development and Planning.

Proceedings of the 8th Session of the Regional Conference on Water Resources Development in Asia and the Far East, November 18-25, 1968, Bangkok, Thailand, p 74-89. Water Resources Series No 38, United Nations. 2 tab, 9 ref, 1 append.

Descriptors: \*Water resources development, \*Long-term planning, Irrigation, Flood control, Hydroelectric power, Water supply, Financing, Manpower, Coordination.

Identifiers: \*Economic development, \*Asia, Water

Rules, procedures and requirements for effectively integrating water resources plans with national integrating water resources plans with national economic development plans are discussed with special consideration given to the ECAFE region. Water resources development, by entering into all sectors of the economy in some form, offers considerable scope for material advancement. Development planning is concerned with the augmentation of resources and their most efficient use for exchanged objectives. Some of the for achieving desired objectives. Some of the ECAFE area water resource projects discussed include irrigation, flood control, power generation, water supply and water transport. To integrate these projects with national economic plans, they must be selected and ranked. Construction schedules must be fixed and executed according to carefully prepared development programmes. Economic planners should make national objectives, policy goals, and strategy of development planning clear to the national water resources development agency. In drafting a water resource development program, consideration should be given to national needs, national and regional goals, specific function and targets of programmes, project priority, investment schedule, and costs and benefits. Vertical and horizontal coordination between water agencies and other agencies concerned insures successful project implementation. Realistic programming must take account of the availability of financing and specialized manpower. (Haugh-Wisconsin) W72-02647

INTERBASIN TRANSFER--THE INTERNA-TIONAL DIMENSION, Alberta Univ., Edmonton. Dept. of Geography.

A. H. Laycock.

Water Resources Bulletin, Vol 7, No 5, p 1017-1026, October, 1971. 31 ref.

Descriptors: \*Inter-basin transfers, \*Compensation, Profit, International waters, Diversion, Water resources development, Planning. Identifiers: \*International transfers, Canada

Interbasin transfers are technically possible on an international scale but extremely few have been developed or have an early prospect of being developed. The institutional constraints are strong and nationalistic reactions to proposals which strongly favor either of the nations involved have uted to delays in development. Most currently proposed schemes involving international water transfers have inadequate provisions for the water transfers nave inadequate provisions for the needs of the areas of origin. Such inadequacies generate substantial opposition because it appears that one nation is attempting to take advantage of another. Consequently, a feasible transfer plan must include an additional payment of profit for the originating nation; just breaking even economically is not enough if significant advantage appears to be gained by the receiver. Many of the more striking illustrations of the problems and opportu-nities relating to institutional transfers are present in the proposals for Canadian water export to the United States. Some proposals have antagonized Canadians and made further negotiations difficult, but phased and sequential transfers are possible and some could complement Canadian develop-ment. This Canadian-U.S. example clearly illustrates a fundamental truism that should be recognized by every transfer scheme: without mutual benefit there will be virtually no international dimension in interbasin transfers. (Settle-Wisconsin) W72-02648

# IDENTIFICATION AND MEASUREMENT OF ECONOMIC PROJECT BENEFITS.

United Nations Office of Technical Cooperation, The Working Group of Experts on Water Resources Planning, August 29-September 9, 1968, Bangkok, Thailand, p 58-70. Planning Water Resources Development, Water Resources Series No 37. 1 fig.

Descriptors: \*Water resources development, \*Economic efficiency, \*Evaluation, \*Benefits, Intendible benefits, Irrigation programs, Hydroelectric power, Flood control, Navigation, Recreation, Water supply, Watershed management. Identifiers: \*Primary benefits, \*Secondary benefits,

Economic efficiency is the criterion used in many ECAFE countries for evaluating effects on the economy of water resource project and programme formulation. It is expressed as a comparison of the value of output (benefits) with the value of inputs (costs). Benefit identification (based on the need for development), the principle and assumptions of benefit measurement, procedures for benefit measurement that have been adopted in ECAFE countries, and the limitations of present evaluation techniques are discussed. The effect of a project is revealed by the difference between the conditions with and without the project. The increase in net gain (output minus inputs) under conditions with the project from the net gain under conditions without the project represents the benefits of a project. Primary, secondary, tangible and intangible benefits are considered. All other possible alternative projects that can meet the estimated future demand must be examined. The bulk of the paper applies this discussion of benefits to the water resource development areas of irrigation, hydropower, flood control, navigation, public water supply, recreation, and watershed management. (Haugh-Wisconsin)

#### FINANCIAL ANALYSIS.

United Nations Office of Technical Cooperation, The Working Group of Experts on Water Resources Planning, August 29-September 9, 1968, Bangkok, Thailand, p 81-99. Planning Water Resources Development, Water Resources Series No 37. 17 tab, 9 ref.

Descriptors: \*V: ater resources development, \*Financial analysis, \*Loans, Capital costs, Operat-ing costs, Maintenance costs, Replacement costs, Cost repayment.

Identifiers: \*Developing countries, \*Project costs, \*Foreign exchange, India, Pakistan, Taiwan.

The financial analysis of a proposed development project consists of a practical plan for financing the project and recovering its cost, taking into account the sources of finance, probable borrowing terms and revenue likely to accrue to the project, phased according to its increased effectiveness. Financial analysis deals with project costs (capital costs and operating, maintenance, and replacement costs) by designating an annual sum to be set aside to amor-tize a loan. This sum is a function of the interest rate, grace period and maturity. It also deals with the foreign-exchange component (loans, credits and grants) and terms of foreign aid. The local-currency component consists mainly of borrowing from the central government, as is the practice in India. The burden of cost falls to the beneficiaries whose repayment capacity may be quite low in the developing countries. To remedy this situation, with regard to irrigation in India, an annual water rate supplemented by a betterment levy was enacted. Financial analysis is illustrated with examples of a myltipurpose acceptain. In Taiwan and a ples of a multipurpose reservoir in Taiwan and a salinity-control and land-reclamation project in West Pakistan. (Haugh-Wisconsin)

THE FINANCING OF WATER RESOURCES DEVELOPMENT WITH PARTICULAR REFERENCE TO THE ROLE OF THE WORLD BANK GROUP IN THE ECAFE REGION,

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International Bank for Reconstruction and Development, Washington, D. C. Advisor on Agricultural Development. T. C. Creyke.

Proceedings of the 8th Session of the Regional Conference on Water Resources Development in Asia and the Far East, November 18-25, 1968, Bangkok, Thailand, p 202-216. Water Resources Series No. 38, United Nations, 3 tab, 1 ref.

Descriptors: \*Water resources development. Pescriptors: "Water resources acceptament, Financing, \*Loans, \*Projects, \*Economic impact, Economic justification, Irrigation, Investment. Identifiers: "World Bank, \*Asia, \*Project financing, West Pakistan, Iran, Indus River basin.

The World Bank, in its role of promoting the economic development of less developed countries, and its affiliate, the International Development Association, created in 1960 to provide more flexible multilateral development loans, are ex-amined as financing agencies in water resource development in the ECAFE region. The approach of these organizations is project-oriented, with financing being devoted to undertakings which make an important contribution to the borrowing country's economy. Standards must be met and projects appraised at the economic, technical, managerial, organizational, commercial and finan-cial levels. Many references to past Bank undertakings and present involvements illustrate these aspects. The ECAFE region has received over 70% of all IDA credits (the majority for India

## Cost Allocation, Cost Sharing, Pricing/Repayment—Group 6C

and Pakistan)AND: S% of all Bank lending. Atable itemizes all Bank/IDA loans for ECAFE water resource development. The trend of the past four years of an increasing share of agricultural lending going for non-water resources projects is likely to going for non-water resources projects is likely to continue. Case studies of the water and power resources of West Pakistan (Indus special study) and the Dez multipurpose project in Iran illustrate the Bank's work in water resource development. (Haugh-Wisconsin) W72-02653

# MEASUREMENT STANDARDS FOR PROJECT EVALUATION--PRICES AND INTEREST BY THE ECAFE SECRETARIAT.

United Nations Office of Technical Cooperation, The Working Group of Experts on Water Resources Planning, August 29-September 9, 1968, Bangkok, Thailand, p 23-34. Planning Water Resources Development, Water Resources Development, Water Resources Series No. 37. 4 tab, 5 ref, 2 append.

Descriptors: \*Water resources development, \*Evaluation, \*Competitive prices, \*Interest, Costbenefit analysis, Risks, Labor supply. Identifiers: \*Opportunity costs, \*Market prices, Price rigidity, Government bonds, Foreign exchange rate, Cambodia, Foreign finance.

A procedure is outlined for assigning prices and in-A procedure is outlined for assigning prices and in-terest rates to physical quantities involved in a pro-ject so that the benefits and costs of projects may be evaluated and compared. Market prices for goods and services should be used but where these are inappropriate, the correct 'shadow prices' (op-portunity costs) are then suggested. The shadow prices for domestic taxed goods are the prices net of the taxes, while the shadow prices for imports of the taxes, while the shadow prices for imports and exports are the international prices. Problems arise when market prices are artificially kept at a level different from the competitive level by a nongovernmental institution (for example, labor prices) or by the government (for example, the foreign exchange rates). In these cases of price rigidity, shadow prices indicate the real value of the goods to the economy. The appropriate interest rate to use is the average yield on long-term government bonds except in cases where corporate taxation is significant. This discount rate correctly incorporates a subjective time preference and measure of technical productivity. Risks and uncertainties must also be considered. The appendices discuss problems of projects financed by foreign loans or grants and summarize a benefit-cost analy-sis of the Prek Thnot project. (Haugh-Wisconsin) W72-02654

#### PROJECT COSTS.

1

United Nations Office of Technical Cooperation, The Working Group of Experts on Water Resources Planning, August 29-September 9, 1968, Bangkok, Thailand. p 35-41. Planning Water Resources Development, Water Resources Resources Development, W Development Series No. 37. 1 fig.

Descriptors: \*Water resources development, \*Project planning, \*Capital costs, Estimated costs, Annual costs, Construction costs, Right-of-way. Identifiers: \*Project costs, Farm development, Population resettlement.

Project costs are defined as the sum of all the expenditures required to realize project objectives. Cost estimates, as a basic planning tool, are of three progressively refined and reliable types: reconnaissance estimates, economic feasibility esti-matesuand pre-construction estimates. The capital costs of a project include all investments necessary to finance construction of the project and place it in operation. Various components of capital costs include lands and rights, population resettlement, construction, farm-development and annual costs. In the area of lands and rights, rights-of-way are needed for each structure of a project. Reservoir

rights-of-way account for most of the needed land. Existing facilities may also need relocation. Reset-tlement of the population contingent to a reservoir area will involve payments for holdings, purchasing resettling areas and moving expenses. Necessary construction costs include those for planning and investigation following neglect, supports and proconstruction costs include those for planning and investigation following project authorization, constructing project works, temporary service facilities, and engineering and administrative services. Farm development costs may include land preparation of the construction for the co tion and consolidation, demonstration farms, and settler assistance. Annual costs provide a common basis for comparing benefits, investment costs, and operation and maintenance costs as well as assessing repayment possibilities. (Haugh-Wisconsin) W72-02655

# PROJECT TO PLAN FOR ORDERLY DEVELOPMENT OF ARKANSAS-VERDIGRIS WATERWAY AREA. VOLUME II: COMPREHENSIVE REPORT.

Frontiers of Science Foundation of Oklahoma, Inc., Oklahoma City.

Report no. ED-71-040, May 71, 532 p, ORC TA69-9 (NEG).

Descriptors: \*Economics, \*Inland waterways, \*Channel improvements, Arkansas, Oklahoma, State government, Employment, Land use, Legislation, Water supply, Flood control, Ecology, Recreation.
Identifiers: Economic development, Arkansas

river, Verdigris river, waterway transportation.

The report describes projected economic, industri-al, and residential development in the Arkansas-Verdigris Waterway area. Volume II reports in detail on task force studies of planning and development in similar areas elsewhere in the Nation, efforts to inform residents of the area about the project and hear their views, environmental in safeguarding against pollution and eyesores, anticipated economic impact including manufacturing, business, housing and recreation, and tourism activities, and legal and legislative studies. Reports from Governors of both States and university and citizen studies are included. W72-02828

#### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

PROGRAMMING APPLICATIONS TO THE ECONOMIC PROBLEMS OF WATER QUALITY CONTROL, Purdue Univ., Lafayette, Ind.

For primary bibliographic entry see Field 06A. W72-02358

DECENTRALIZABILITY OF A STOCHASTIC OPTIMIZATION APPROACH TO WATER RESOURCE ALLOCATION, Hawaii Univ., Honolulu. Dept. of Business

Hawaii Univ., Honolulu. Dept. Economics and Quantitative Methods. For primary bibliographic entry see Field 06A.
W72-02359

DISPOSAL OF WASTES FROM WATER TREATMENT PLANTS-PART 3-SECTION 2, REPORT ON CURRENT TECHNOLOGY AND

American Water Works Association Research Foundation, New York. For primary bibliographic entry see Field 05D. W72-02390

FINANCING OF MUNICIPAL FACILITIES TREATING INDUSTRIAL WASTES, Environmental Protection Agency, Washington, D.C. Office of Water Programs For primary bibliographic entry see Field 05G. W72-02399

THE RANGE OF CHOICE IN URBAN WATER MANAGEMENT: DEMAND MANAGEMENT THROUGH RESPONSIVE PRICING,

Johns Hopkins Univ., Baltimore, Md.
Steve H. Hanke, and Robert K. Davis.
Ninety-first Annual Conference, American Water
Works Association, Denver, Colorado, June 13-18, 1971. 28 p, 1 fig, 5 tab, 22 ref. OWRR Project 1748 (No 3165) (2) and C-1357 (No 1972) (3).

Descriptors: \*Water rates, \*Water supply, \*Water demand, Administration, Water utilization, Water users, Planning, Peak loads, Municipal water, Ci-

Identifiers: \*Summertime water use, \*Peak responsibility pricing.

Demand management through the instrument of pricing policy was studied as an alternative to conventional water supply management. Summertime uses of water for lawn irrigation and similar outdoor uses are particularly sensitive to the price charged. Since it is the rapid growth of summertime demands which are placing pressures on city water systems to expand capacity, a two-season pricing policy is proposed which places the responsibility for paying for system expansion on summertime users. A trial application of a peak responsibility model to the Washington, D.C. area shows that such a policy would radically change the existing water supply picture, and that peak 'requirements' for summertime water might be greatly reduced. The anticipated investments in reservoir storage and system capacity to cope with growth in summer peak days can be postponed by perhaps more than ten years. Pricing policy combined with supply management provides the utility manager with the means to assure: (1) a more efficient utilization of the resources employed to produce and distribute water; and (2) a more equitable distribution of the costs incurred in providing water services. Poertner) W72-02432

INTERBASIN TRANSFERS OF WATER, ECONOMIC ISSUES AND IMPACTS, Colorado Univ., Boulder. Dept. of Economics; and Minnesota Univ., Minneapolis. Dept. Economics. For primary bibliographic entry see Field 03B. W72-02436

COST OF INDUSTRIAL AND MUNICIPAL WASTE TREATMENT IN THE MAUMEE RIVER BASIN,

Enjay Chemical Co., Baytown, Tex., and Toledo Univ., Ohio. For primary bibliographic entry see Field 05D. W72-02437

A NEW THEORY OF PRICING AND DECISION-

-MAKING IN PUBLIC INVESTMENTS, Florida Univ., Gainsville, Dept. of Agriculture; and Krannert Graduate School of Industrial Adminis tration, Lafavette, Ind. man, and A. Whinston.

OWRR Research report, August, 1970. 41 p, 14

Descriptors: \*Investment, \*Cost allocation, \*Pricing, \*Public benefits, \*Decision making, Demand, ing, "Funic benefits, "Decision making, Demand, Financing, Optimization, Welfare (Economics). Identifiers: "Public goods, "Public investments, "Price setting, "Social incremental costs.

A theory for price setting in public investments (including public goods) is developed, and its usefulness in choosing and financing optimal investments indicated. Public investments and goods are considered as cases of joint supplies and costs where a good is to be supplied to and paid for by several goods in to be supplied to and paid for by several users and any increase in the good's quantity is equally available to all users. The proposed pricing system is based on the concept of each user paying the social incremental costs due to his demands. By definition, the incremental cost scheme satisfies the necessary marginal conditions for social welfare

#### Field 06-WATER RESOURCES PLANNING

#### Group 6C—Cost Allocation, Cost Sharing, Pricing/Repayment

maximization just as marginal cost pricing does. However, in the case of increasing returns to scale, unlike marginal cost pricing, this scheme covers full costs. This incremental cost model gives rise to a fair system of charges and each user will have incentives to accept the charge since alternative ways of satisfying his demands will be moe costly. Since users may have quite different demands, incremental cost charges will not be uniform. Finally, the incremental cost model implies that at the optimum investment, the marginal unit should be charged marginal cost which is the condition necessary for welfare maximization. (Settle-Wisconsin) W72-02440

IRRIGATION DEVELOPMENT COST AT THE FARM LEVEL,

Food and Agriculture Organization of the United Nations, Bangkok (Thailand). For primary bibliographic entry see Field 03F.

W72-02443

THE WAR ON POLLUTION, ECONOMIC AND

FINANCIAL IMPACTS,
Virginia Univ., Charlottesville. Graduate School of
Business Administration.

For primary bibliographic entry see Field 05G. W72-02445

ECONOMIES ASSOCIATED WITH SIZE OF WATER UTILITIES AND COMMUNITIES SERVED IN NEW HAMPSHIRE AND NEW EN-

New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.

Water Resources Bulletin, Vol 7, No 5, p 905-912, October, 1971, 5 tab, 5 ref.

Descriptors: \*Utilities, \*Water utilization, \*Econo-Descriptors: "Othlites, water tunization, become mies of scale, \*Elasticity of supply, Total costs, Unit costs, Regression analysis, New England. Identifiers: \*Economies of production.

Regression analysis techniques were employed to investigate the relationship between the costs of providing water to New England communities and (1) the quantity of water produced by the utility, and (2) the size of the community. Th annual water cost and production data used were obtained from the American Directory of Water Utilities (1968-1969) and were for the years 1965-1967. For New England, exclusing New Hampshire, a one percent increase in total water produced was associated with an 0.916 percent increase in total cost. For New Hampshire utilities on metered systems there appeared to be no such economies of production. A one percent change in water produced, holding number of water users constant, resulted in a cost increase of 0.1 to 0.3 percent, indicating that the most costly part of increased water production lies in increasing the number of customers. The same cost behaviour exhibited by this total cost data was also observed for unit cost data, that is, for cost per 1,000 gallons produced. Finally, analysis of the elasticity of total cost indicated that increases in community size may more than offset the economies associated with an increased volume of water produced. (Settle-Wisconsin) W72-02451

ECONOMIC AND ENVIRONMENTAL IMPACTS OF THE PROPOSED SOUTH CAROLINA TAX CREDIT FOR INDUSTRIAL POLLUTION CONTROL FACILITIES, Clemson Univ., S.C. Dept. of Agricultural

For primary bibliographic entry see Field 05G. W72-02453 Economics.

POLICIES AND METHODS PERTAINING TO THE FINANCING OF WATER RESOURCES PROJECTS AND REPAYMENT OF PROJECT

COSTS.

Proceedings of the 8th Session of the Regional Conference on Water Resources Development in Asia and the Far East, November 18-25, 1968, Bangkok, Thailand, p 33-59. Water Resources Se-ries No 38, United Nations. 15 tab, 8 ref, 1 append.

Descriptors: \*Water resources development, \*Project planning, \*Financing, \*Loans, \*Cost repayment, \*Capital, Non-reimbursable costs, Operating

Identifiers: \*Project costs, Foreign exchange, Taiwan, Pakistan, Ghana, India, World Bank.

Because of the increasing cost and complexity of development projects, water resource development is becoming financially unfeasible and straining the resources of developing countries. The final aspects of development projects, therefore, need close examination. Possible sources of domestic and foreign capital and the terms under which they are currently available are investigated. The borrowing terms (the grace period, repayment period, and interest rate) have considerable bearing on the ultimate project cost and charges levied to recover the cost. The ultimate test of project validity is its financial soundness. This is demonstrated by the repayment schedules which show the anticipated capital and operating costs and the annual anticipated revenue throughout the repayment periods of the loans. To illustrate the methodology of financial analysis, how projects are being financed, borrowing conditions and repayment possibilities, four case studies are cited, a reservoir project in Taiwan, a groundwater and salinity con-Ghana and an irrigation project in India. (Haugh-Wisconsin) W72-02651

FINANCIAL ANALYSIS.

For primary bibliographic entry see Field 06B. W72-02652

MEASUREMENT STANDARDS FOR PROJECT EVALUATION--PRICES AND INTEREST BY THE ECAFE SECRETARIAT.

For primary bibliographic entry see Field 06B. W72-02654

PROJECT COSTS.

For primary bibliographic entry see Field 06B. W72-02655

COST OF DOMESTIC WELLS AND WATER TREATMENT IN ILLINOIS,

Illinois State Water Survey, Urbana.

J. P. Gibb.

GroundWater, Vol 9, No 5, p 40-49, September-October 1971. 11 fig, 4 ref.

Descriptors: \*Water costs, \*Domestic water, \*Water wells, \*Water treatment, \*Illinois, Groundwater, Economics, Construction costs, Operating

Cost information is given for private home groundwater supply systems in Illinois. With 10-gpm sub-mersible pumps the average cost is about \$585 with 50 percent ranging between \$400 and \$680. The costs of treating water for domestic use also are summarized. Two maps show the probable costs of domestic raw water-supply systems from sand and gravel wells and bedrock wells throughout the State. For an average installation and domestic use rate in Illinois, the monthly cost of raw water is about \$11.00, softened water \$15.40, softened water treated for iron \$22.00, and softened water treated for iron and chlorinated \$25.00. Similar calculations for any type and depth of well, water quality, and treatment can be made. (Knapp-W72-02753

6D. Water Demand

WATER RESOURCES PLANNING IN URBAN

DEVELOPMENT,
Wapora, Inc., Washington, D. C.
For primary bibliographic entry see Field 06B.
W72-02294

UPPER MISSISSIPPI RIVER COMPREHENSIVE BASIN STUDY, APPENDIX P, VOLUME VIII, ECONOMIC BASE STUDY AND PROJEC-TIONS, 1970.

Corps of Engineers, Chicago, Ill. North Central Div

For primary bibliographic entry see Field 06B. W72-02439

A SPATIAL ALLOCATION MODEL FOR PROJECTED OUTDOOR RECREATION DEMAND: A CASE STUDY OF THE CENTRAL UPSTATE NEW YORK REGION, For primary bibliographic entry see Field 06A. W72-02441

**NEXT BIG INDUSTRY: ENVIRONMENTAL IM-**PROVEMENT, Dartmouth Coll. Hanover, N.H. Amos Tuck School

of Business Administration. J. B. Quinn.

Harvard Business Review, p 120-131, September-October, 1971, 3 tab, 3 ref

Descriptors: \*Ecology, \*Demand, \*Costs, Government supports, Institutions, Political aspects, Regulation, Standards.

Identifiers: \*Environmental improvement, \*Public goods, \*Markets, \*Economic growth, \*Industry.

Environmental improvement, far from being a costly drain on the economy, can create a dynamic profitable series of self-supporting markets for in-dustry which add to the GNP. Markets for public goods (for example, environmental improvement) remain unsaturated and can be produced by aggregating individual demands or imposing governmental regulations. The costs involved in creating these new markets are the same as for any demand change in a market economy. A lower growth rate in private demand for goods and services will be ex-perienced in the short run. In addition, some marginal firms will be displaced due to immediate increased depollution costs. Finally, small price changes will seriously affect industries with high product substitutability. Responsibility for creating product substitutability. Responsibility for creaming public markets, by converting public demand for environmental improvement, must fall to the businessmen. Public markets must be properly developed and given top priority in order to be financed by the economic growth they create. Nationwide standards must be set, enforced, accompanied by favorable fiscal policy, and backed up by regulating agencies. Needed practices and institutional changes will only occur if industry acts vigorously and consistently in its long-term self-in-terest. Many historic analogies are cited and serve to reinforce the conclusions. (Haugh-Wisconsin) W72-02446

EFFECTS OF INTERBASIN TRANSFERS UPON WATER MANAGEMENT ALTERNATIVES IN CENTRAL UTAH, Colorado State Univ., Fort Collins. Dept. of

Colorado State Oniv., For Collins. Dept. of Agricultural Engineering. G. V. Skogerboe, and T. L. Huntzinger. Water Resources Bulletin, Vol 7, No 5, p 1027-1037, October, 1971. 8 fig, 2 tab, 5 ref.

Descriptors: \*Water demand, \*Water users, \*Water management (Applied), \*Water con-veyance, Future planning (Projected), Municipal water, Irrigation water, Industrial water, Utah. Identifiers: \*Utah Lake drainage area, Central Utah Project.

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W72-024

Descripto \*Hydroel Identifiers Withdray \*Municipa

#### Water Law and Institutions—Group 6E

Most of Utah's rapid population and industrial exmost of Otah's rapid population and industrial ex-pansion is taking place along the western base of the Wasatch Mountains, with consequent increases in water demand. Projections for the Utah Lake drainage area indicate that from 1960 to 2020 (1) population will increase from 112,100 to 334,000, (2) municipal water demand will increase from 29,800 acre-feet to 102,000, (3) industrial wat demand, in acre-feet, will increase from 75,000 to 167,000, and (4) agricultural water demand, in acre-feet, will decrease from 674,100 to 514,000. The expected net increase in mean annual water demand for this period is 4,000 acre-feet. If an overall irrigation efficiency of 68% can be achieved, there is sufficient water in the Utah Lake drainage area to meet water needs to the year 2020. However, the need to provide additional storage to reduce agricultural water shortages would still exist. Furthermore, additional water conveyance systems would be required to move water from areas of abundance to those areas contents. sistently encountering shortages. The Central Utah Project provides such a means for reallocating the existing waters in the Utah Lake drainage area. (Settle-Wisconsin) W72-02450

RECREATIONAL PARKS AND BEACHES: PEAK DEMAND, QUALITY AND MANAGE-

California Univ., Davis. For primary bibliographic entry see Field 06B. W72-02452

WATER RESIDENTIAL DEMAND AND ECONOMIC DEVELOPMENT.

University of Toronto Press, 1969. 151 p, 17 fig, 61 tab, 212 ref, 2 append.

Descriptors: \*Water supply, \*Water demand, \*Optimum development plans, \*Investment, Social impact, Economic impact, Municipal water, Welfare (Economics), Social aspects.
Identifiers: \*India, Social overhead capital.

The relationship between water supply and economic development and the components of the demand function for domestic water is studied by demand function for domestic water is studied by examining the existing water-use system in two urban areas of India. The analysis suggests that, apart from contributing to public health, the provision of public water supplies is not critical to the process of economic development. It is necessary, therefore, to reappraise the role of the water supply compared with alternative investments in social overhead capital and more directly productive ac-tivities. Solution to the dilemma of finding the op-timum level of investment in a water supply system lies in understanding the composition of the demand function for water consumed for domestic use; that is, once the relationships between the demand for water and the level of the living environment are known, an attempt can be made to ensure that the level of investment in water supply approaches the optimum consistent with the achievement of economic growth. This study indicates that the demand for domestic water supply is a function of the accessibility of water, housing conditions, level of income, and water-using habits. (Settle-W72-02457

APPENDIX B - WATER USE COEFFICIENTS AND SELECTED AGGREGATES,

New Mexico Univ., Albuquerque. N. Wollman, and G. W. Bonem. In: The Outlook for Water, The Johns Hopkins Press, Baltimore, 1971, p 174-194. 23 tab, 41 ref.

Descriptors: \*Water users, \*Withdrawal, \*Mining, \*Hydroelectric power, \*Irrigation, Recirculated

Identifiers: dentifiers: \*Projections, \*Coefficients,
\*Withdrawal losses, \*Water use, \*Manufacturing, \*Municipal use.

Projections of water withdrawals and losses are calculated for agriculture, mining, manufacturing, steam-electric power, and municipal use. The tables present the results. For agriculture, projections of water withdrawals and losses were obtained as the product of the projections of irrigated acreage in each region multiplied by projected water withdrawals and losses per irrigated acre in each region. Estimates of water use for mining were calcu-lated from the Bureau of Mines estimates of water intake and losses for 1962 and adjustment of these figures by the ratio of output in the various sectors in 1960 to that in 1962. For manufacturing, water withdrawals and losses were established as the product of value added projected for five manufacturing sectors (food and kindred products, paper and pulp products, chemical and allied products, petroleum and coal products, and primary metals), and the projections of water withdrawal and loss coefficients. The amount of fresh water withdrawn per kilowatt-hour for utility steam-electric power generation depends on: the amount of intake plus the amount of water recirculated; the amount of gross water applied which is withdrawn from brackish sources; and the rate of recirculation. orackish sources; and the rate of recirculation.
Total municipal withdrawals in each region were
estimated as the product of urban population and
average per capita use. In Appendix C, 14 additional tables deal with aggregate withdrawals and
losses for the major water uses of agriculture, mining, manufacturing, steam-electric power, and mu-nicipal use. (Strachan-Chicago) W72-02604

CHAPTER VII - WITHDRAWALS AND LOSSES: ALL USES,

New Mexico Univ., Albuquerque.
N. Wollman, and G. W. Bonem.
In: The Outlook for Water, The Johns Hopkins

Press, Baltimore, 1971, p 55-65. 16 tab, 6 ref.

Descriptors: \*Water users, \*Withdrawal, \*Water utilization, Agriculture, Mining, Hydroelectric power, Recirculated water. Identifiers: \*Withdrawal uses, \*Withdrawal losses,

\*Water use, \*Projections, Manufacturing, Mu-

Sixteen tables of withdrawal uses and losses are presented and discussed. Withdrawals are a common measure of water use. The projections presented in the tables indicate a sharp change in the relative importance of different withdrawal over the next fifty to sixty years. According to the Medium projection, between 1960 and the year 2020 there will be a decline in absolute withdrawals for agriculture. As of 1960, agriculture accounted for slightly more than half of aggregate withdrawals. This decline in agriculture withdrawal use is the only such decline projected for the five major categories of agriculture, mining, manufacturing, municipal use, and steam-electric power.
Mining uses decline in relative importance, although they grow absolutely. Manufacturing and municipal uses grow slightly in relative importance. The biggest foreseeable growth, absolute and relative, is that of steam-electric power. This indicated growth is a function of the projected output of power coupled with assumed rates of recirculation. (Strachan-Chicago) W72-02611

CHAPTER VI - COEFFICIENTS OF WATER USE: WITHDRAWAL USES,

New Mexico Univ., Albuquerque. For primary bibliographic entry see Field 06B. W72-02612

#### 6E. Water Law and Institutions

IDAHO (ANALYSIS OF WATER POLLUTION LAW AND COMPARISON WITH PRESENT AND PROPOSED TENNESSEE LAW), Frank E. Maloney, and Jon Heaton.

In: The 1971 Water Pollution Study for the State of Tennessee, Append 14, 1971. 16 p, 2 tab.

Descriptors: \*Idaho, \*Water pollution control, \*Administrative agencies, \*Pollution abatement, Water supply, Water quality control, State govern-ments, Legislation, Legal aspects, Permits, Ef-fluents, Standards, Administration, Judicial deci-sions, Sewage disposal, Tennessee.

Since pollution is not a major problem in Idaho, its legislature has not established laws designed to legislature has not established laws designed to prevent or abate pollution. The law is almost en-tirely remedial. A striking feature of the law is that there is no water pollution board. Rather, the regu-lation of pollution is a duty of the state board of health. Board members have a rather wide inde-pendence, though serving at the pleasure of the governor. Many important areas of water control, such as sewage systems, public water supplies, and drinking water systems, are under direct control of drinking water systems, are under direct control of the board. No authority to classify waters is provided; however, the board is authorized to set ef-fluent standards and to establish a permit system. No financial incentives are given to encourage pol-lution abatement. The board's enforcement power is restricted, since it has no power to issue orders or to enter private property to perform its duties. All enforcement action must be made through the courts. The fines fixed by law are high enough to effectively deter violations. The board's final determinations can be reviewed by the courts. Two ta-bles compare Idaho pollution control law with the present and proposed law of Tennessee. (See also W72-00475) (Shelmut-Florida) W72-02254

DECISION AND INSTITUTIONAL ASPECTS OF WEATHER MODIFICATION, Harvard Univ., Cambridge, Mass. Div. of Engineer-ing and Applied Physes.

ing and Applied Physes.

M. B. Fiering, M. Horowitz, and D. F. Luecke.

Availabile from National Technical Information
Service, Springfield, Va 22151 as PB-201 101,
\$3.00 paper copy; \$0.95 microfiche. Harvard
University Division of Engineering and Applied
Physics Final Report 14-06-D-6850, June 1971.
144 p, 27 fig. 12 tab, 199 ref. Contract 14-06-D
(Bur Reclaim).

Descriptors: \*Weather modification, \*Legal aspects, \*Jurisdiction, \*Mathematical models, \*Systems analysis, Insurance, Damages, Decision making, Computers, Input-output analysis, Artificial storms, Artificial precipitation.

A mathematical model of the jury decision-making process shows that large instabilities are inherent in the existing legal systems applied to recovery of damages alleged to arise from attempts to modify the weather. The decision-making process is shown to be generally biased in favor of the defendant. If the model is applied to decision-making by a panel of experts it shows improved stability. Another mathematical model develops decision rules for precipitation augmentation, but unlike earlier models, this study explicitly includes economic measures of risk; these affect precipitation augmentation augmentation by promoting changes in systems opera-tion coupled with small increments in precipitation (with small risk) as constrasted to large increments with correspondingly large risk. A model of an in-surance fund for damage claims is presented. Finally, a model statute is offered for establishing efforts in weather modification. (Woodard-USGS)
W72-02299

GERBING V. ITT RAYONIER (QUI TAM ACTION UNDER RIVERS AND HARBORS ACT). I Environmental L. Rep. 20368-20369 (M.D. Fla. July 21, 1971).

\*United States, \*Rivers and Harbors Act, \*Pulp wastes, \*Pollution abatement, Federal government, Judicial decisions, Legal aspects, Water law, Legislation, Regulation, Non-structural alterna-tives, Negotiation, Sulfates, Industrial wastes, Water pollution, Water pollution sources, Waste disposal, Rivers, Environmental sanitation, Navigable waters, Water pollution control, Public rights. Identifiers: \*Qui tam actions, \*Refuse Act.

## Field 06-WATER RESOURCES PLANNING

### Group 6E-Water Law and Institutions

Plaintiff private citizen sought assessment of fines against defendant sulfite manufacturer for al-legedly unlawful discharges of refuse into a river. Plaintiff had asked the United States Attorney to enforce the appropriate sections of the Rivers and Harbors Act of 1899, but the government failed to take any action. Plaintiff attempted to invoke the Refuse Act through a qui tam proceeding: an ac-tion brought on behalf of the government by an in-former seeking civil penalties. The District Court for the Middle District of Florida ruled that the Refuse Act does not authorize a civil qui tam action by a private party aimed at imposing criminal penalties on a suspected polluter, even if the government has failed to act. The Court also found that the enforcement of the Act was placed in the hands of the Department of Justice with broad discretion in the court of the Act was placed in the Act was placed in the Court of the Act was placed in the Act was cretion in determining whether or not to prosecute possible violations. In exercising this discretion United States Attorneys are immune from interference by private citizens or the courts. The court dismissed plaintiff's suit. (Johnson-Florida)

#### FINNELL V. PITTS (LIABILITY OF STATE OF-FICERS FOR STATE TORT).

21132 So. 2-20 (Ala. 1930).

Descriptors: \*Alabama, \*Highways, \*Eminent domain, \*Flooding, State governments, Compensa-tion, Condemnation, Landfills, Streams, Obstruction to flow, Legal aspects, Judicial decisions.

Plaintiff farmowner sued defendant state officers to recover compensation for flooding of his land resulting from construction of a highway. Defendants built a highway close to plaintiff's farm and constructed an embankment across a stream, which caused it to back up over plaintiff's land Plaintiff based his action on the constitutional prohibition of taking without just compensation. Defendants asserted sovereign immunity. The Supreme Court of Alabama held that no inhibition existed to a suit against the state officers in their personal capacity. Defendant also contended that the overflow was unforeseeable and indirect, and that therefore the damages were consequential. The court, however, held that the submergence of plaintiff's land was a taking, for which plaintiff must be compensated. Defendants' contention that they should not be held liable because they did not begin the work was rejected. (Hart-Florida) W72-02323

#### CITY OF LOGANSPORT V. COTNER (MU-NICIPAL LIABILITY TO PROPERTY OWNERS FROM OBSTRUCTED STORM DRAINS). 185 N.E. 634-636 (Ind. 1933).

\*Indiana, \*Storm drains, \*Flood damages, \*Cities, Legislation, Taxation, Assessments, Surface runoff, Legisiation, Jascation, Assessients, Suntace Union, Storms, Cloudbursts, Storm runoff, Surface drainage, Drains, Drain tiles, Drainage systems, Public utilities, Sewers, Drainage water, Judicial decisions, Legal aspects, Administrative decisions.

Plaintiffs brought an action against defendant city for damages resulting from flooding when city storm drains became obstructed. These drains had been built solely from a special assessment on plaintiffs' property. Defendant contended that where a city constructs a drain not so required, it may abandon it at will and shall not be liable for negligence where the adjoining landowner was left in no worse condition than before the drain was constructed. Defendant also contended that liabiliconstructed. Detendant asso contended that habity arises only when faulty construction or negligent maintenance created a body of water that precipitated upon adjoining lands. In affirming a lower court judgment for plaintiff, the Supreme Court of Indiana held that by state statute construction and maintenance of the state tion and maintenance of sewers and drains were within the ministerial powers of the city. The city had complete discretion and power to determine the advisability, the time, and the manner of construction. By such action the public utility of the project is established, and the city is bound by its determination. The project became part of the general city drainage system even though its cost was assessed against property specially benefited. Therefore, the city had failed its statutory duty to keep the drain in repair and indicated a lack of reasonable care as would constitute negligence. W72-02324

#### CITY OF RICHMOND V. WRIGHT (LIABILITY OF CITY FOR MENTAL ANGUISH CAUSED BY FLOOD DAMAGE TO HOME). 145 S. E. 732-735 (Va Ct App, Spec, 1938).

Descriptors: \*Virginia, \*Cities, \*Floods, \*Culverts, \*Damages, Adjudication procedure, Legal aspects, Judicial decisions, Rain, Rainfall, Storm runoff, Surface runoff, Surface water, Water injury, Floods, Flood damage.

Plaintiff landowner sued defendant municipality to recover damages occasioned by floodwater. Plaintiff's land was adjacent to a ravine upon which defendant constructed an embankment. Following a heavy rain, water backed up from defendant's cul-vert, under the embankment, and flooded plaintiff's home. Defendant excepted to a jury instruc-tion permitting plaintiff to recover for 'incon-venience, annoyance, and discomfort suffered'. The complaint, however, did not assert such damages. Defendant contended the instruction amounted to mental anguish. Since no evidence was presented of pecuniary damage for 'inconvenience, annoyance, and discomfort', the court held that the lower court erred in giving the instruction. The only allowable damages proven by plain-tiff totalled \$650, while the jury verdict amounted to \$1500; therefore, the court entered a \$650 judgment for plaintiff. The trial court also refused instructions that: (1) defendant's enlargement of the culvert should not be considered an admission of inadequacy of the earlier culvert, and (2) defendant could not be held liable for its exercise of discretion in selecting culvert size unless it had notice by experience of the culvert's inadequacy. The court rejected defendant's assertion of error in the trial court's refusal to give these instructions. (Hart-Florida)

# SMALL WATERSHED AND DRAINAGE LAWS

OF NORTH CAROLINA, North Carolina Univ., Chapel Hill. Water Resources Research Inst. Milton S. Heath, Jr.

Available from the National Technical Information Service as PB-205 177, \$3.00 in paper copy, \$0.95 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Report No 53, UNC-WRRI-71-53, January 1971. 27 p. OWRR A-999-

Descriptors: \*Legislation, Watershed protection and Flood Prevention Act, \*Local governments, \*North Carolina, \*Legal aspects, \*Watershed management.
Identifiers: \*Small watershed laws, \*Drainage

This study for the Office of Water and Air Resources, N. C. Department of Natural and Economic Resources involved a review of small watershed and drainage laws of North Carolina with recommendations for legislative revision. Report was basic reference for General Assembly amendments in 1971. (Howells-North Carolina) W72-02353

# MACDOUGALD CONST. CO. V. BASS CANNING CO. (CITY'S LIABILITY FOR ADOPTING FAULTY DRAINAGE PLAN).

156 S.E. 628-630 (Ct. App. Ga. 1931).

Descriptors: \*Georgia, \*Cities, \*Surface runoff, \*Storm drains, Drainage systems, Sewers, Surface

water, Manholes, Contracts, Legal aspects, Judicial decisions, Flood damage, Floods.

Plaintiff warehouse owner sued defendants city and construction company to recover damages to the warehouse when surface water flooded it. Defendant city adopted a plan to pave the street in front of plaintiff's warehouse and construct storm sewers of plaintiff's warehouse and construct storm sewers as necessary. Where there had previously been a surface drainage ditch draining into a perpendicular sewer, the plan required the sewer mouth to be raised four feet and converted into a closed manhole. No opening was left for water to drain into. Consequently plaintiff's warehouse was flooded Defendants were advised of the defect, but they failed to correct it. Plaintiff contended that defendant were liable for sealingness it failing to correct. dants were liable for negligence in failing to correct the defect. The Court of Appeals of Georgia, how-ever, stated that defendant city's duties in adopting the plan were of a quasi-judicial nature, involving wide discretion, and that defendant city was not liable for adoption of a faulty plan caused by an error in judgment. Since plaintiff conceded that defendant city and the statement of the content of the conten dants were not negligent in executing the faulty plan, the court held that the complaint failed to state a cause of action. It ruled that the lower court had erred in not sustaining the demurrer. (Hart-W72-02368

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# UNITED STATES V. DISTRICT COURT IN AND FOR COUNTY OF EAGLE, COLORADO (JOINDER OF UNITED STATES AS DEFENDANT UNDER A FEDERAL STATUTE CON-SENTING T 91 Sup. Ct. 998-1003 (1971). 6 p.

Descriptors: \*Colorado, \*United States, \*State jurisdiction, \*Federal-state water rights conflicts, Legislation, Water rights, Judicial decisions, Legal aspects, Appropriation, Preferences (Water rights), Prior appropriation, Federal jurisdiction, Withdrawn lands, Federal reservations, Public lands, National forests.

Plaintiff United States sought a writ of prohibition in the Colorado Supreme Court to preclude the Eagle County district court from asserting jurisdiction over plaintiff for adjudication of water rights covering the Eagle River system. When the supreme court discharged the rule, the United States Supreme Court granted plaintiff's petition for certiorari. The attempted joinder was pursuant to a federal statute giving consent to join the United States as defendant in a suit for administra-tion of rights to use of water of a river system. Plaintiff had reserved waters for a national forest from the Eagle River. Plaintiff contended that the from the Eagle River. Plaintiff contended that the statute only applies to water rights acquired under state law, and does not consent to have adjudicated in state courts the reservation of water rights by the United States arising from withdrawals of land from the public domain. The Supreme Court held that the statute is an allinclusive provision subjecting to general adjudication in state proceedings all rights of the United States to water within a particular state's jurisdiction regardless of how they were acquired. Also, the court held that any conflict between adjudicated rights and reserved rights of the United States, if preserved in the state proceeding, can be reviewed by the Supreme Court. (Hart-Florida) W72-02373

# BASS ANGLERS SPORTSMAN'S SOCIETY OF AMERICA V. SCHOLZE TANNERY, INC. (PRIVATE RIGHT TO ENFORCEMENT OF THE RIVERS AND HARBORS ACT) 329 F. Supp. 339-350 (E.D. Tenn. 1971)

Descriptors: \*United States, \*Rivers and Harbors Act, \*Water pollution control, Administrative decisions, Judicial decisions, Legal aspects, Federal government, Water law, Permits, Administration, Legislation, Administrative agencies, Waste disposal, Water pollution sources, Water poll ution, Regulation, Standards, Decision making.

Plaintiff conservation groups sought to recover penalties and obtain injunctive relief for alleged violations of the Rivers and Harbors Act of 1899 by defendant corporations and government agencies. Violation of the Act was made a crime and one-half of any fine imposed was to be paid to any infor-mers. Plaintiff contended that they had the right to prosecute the suit as a qui tam action and that they were proper parties to seek an injunction against defendants' discharges and against defendant agency's failure to establish a permit system for such discharges. The United States District Court for the Eastern District of Tennessee dismissed the action and ruled that the Act created and defined crimes which could be enforced exclusively by the Department of Justice in its discretion. Private citizens cannot compel the exercise of this discretion by a qui tam action. Enjoining the discharges under the Act is permissible but such relief must be sought by the appropriate governmental agency. The court also held that the exercise of the discretion to establish a permit system could not be compelled by plaintiffs. (Johnson-Florida) W72-02381

CAPE MAY COUNTY CHAPTER, INC., IZAAC WALTON LEAGUE OF AMERICA V MACCHIA (CONSERVATION GROUP'S STANDING TO SUE UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT).
329 F. Supp. 504-517 (D. N. J. 1971).1

Descriptors: \*United states, \*Jurisdiction, \*Public rights, "Environmental effects, Judicial decisions, Legal aspects, Water law, Federal government, State governments, Rivers and Harbors Act, Water Quality Act, Permits, Regulation, Riparian rights, Administrative mensies Administrative agencies, Ecology, Estuarine en-vironment, Mortality, Tidal waters, Landfills, Land development, Dredging, Legislation. Identifiers: \*National Environmental Policy Act.

Plaintiff conservation group sought a declaratory judgment, an injunction, and damages with respect to the preservation and protection of marine related resources from dredge and fill operations of defendant land developers. Plaintiff contended that defendants had exceeded their permit limitations and that their operations would harm offshore fisheries in violation of the National Environmental Policy Act (NEPA) and other acts Defendants Policy Act (NEPA) and other acts. Defendants roncy Act (NEPA) and other acts. Defendants moved to dismiss the case arguing that plaintiffs did not have standing to sue. The District Court for the District of New Jersey denied the motion and held that plaintiff had standing to sue. The two requirements for standing are: (1) plaintiff must suffer alleged injury in fact from the challenged action and (2) the interest sought to be protected must be arreadally within the zone of interests cought to be accounted. guably within the zone of interests sought to be pro-tected by the statute in question. The Court felt that the concept of standing should not be narrowly construed because of the need to protect the environment against uncoordinated or irresponsible conduct. The conservation group had stated a suffi-cient cause of action under the NEPA and sought to protect aesthetic, conservational, and recreational interests affecting them. (Johnson-Florida)

UNITED STATES V. 422,978 SQUARE FEET OF LAND, SAN FRANCISCO (RIGHT OF UNITED STATES TO CONDEMN SUBMERGED LANDS FOR NAVIGATION WITHOUT COMPENSA-

445 F .2d 1180-1189 (9th Cir. 1971).

Descriptors: \*Condemnation, \*United States, \*\*Compensation, \*Ownership of beds, \*Navigable waters, Beds under water, Eminent domain, Legal aspects, Judicial decisions, Navigation, Easements, Federal government, State governments, California, Bays, Docks, Ships, Relative rights, Land Identifiers: \*Navigational servitude.

In an action in rem by the United States to con-demn submerged land in San Francisco Bay,

California appealed from a federal district court order dismissing its complaint in condemnation. The United States contended no compensation was required because it had exercised its navigational ment and the statute of limitations under the Tucker Act had run against the State. In 1940, the United States had taken physical possession of the disputed lands, including a wharf facility, in connection with the San Francisco Naval Shipyard. At that time, California requested that a rental agree-ment be made, but the United States refused to pay more than a nominal fee. California did not bring an action for compensation during this period. Following decisions of the United States Supreme Court, the Ninth Circuit Court of Appeals held that the United States could use submerged lands for navigational purposes without paying compensa-tion. Furthermore, the court held that use in conjunction with a naval shipyard was a navigational purpose, not requiring compensation. The court further observed that California's claim for compensation was barred by the statute of limitations under the Tucker Act, despite the state's assertion that it never had a claim for relief under the Tucker Act. (Hart-Florida) W72-02418

UNITED STATES V. UNITED STATES STEEL CO. (PROSECUTION UNDER THE REFUSE

328 F. Supp. 354-360 (N.D. Ind. 1970).

Descriptors: \*Rivers and Harbors Act, \*Water pollution control, \*Water Quality Act, \*Pollutants, \*United States, Water pollution, Water pollution sources, Water quality, Water quality control, Legislation, Legal aspects, Pollution abatement, Federal government, State governments, Standards, Industries, Industrial wastes, Judicial decisions, Adjudication procedure.

Identifiers: \*Constitutionality, \*Refuse Act. \*Water Pollution Control Act.

Defendant corporation moved to dismiss an information filed under the Refuse Act of 1899 by plaintiff United States. Defendant contended: (1) the Act required scienter, but the information did not allege it; (2) the Act only proscribes pollution which obstructs navigation; (3) the information did not allege violation of water quality standards, as required; (4) the Act was unconstitutionally vague; (5) the Act deprived defendant of riparian rights without due process; and (6) the Federal Water Pollution Control Act (FWPCA) and the Refuse Act, read together, create an unconstitutional result. The federal district court determined that: (1) the Act was malum prohibitum and did not require scienter; (2) all pollution of navigable waters, except that from streets and sewers, was prohibited by the Act; (3) the Refuse Act could be violated by a discharge despite compliance with water quality standards; (4) the Act was not unconstitutionally vague because the term 'refuse' is all inclusive, and no great exercise of judgment is necessary to determine what constitutes a violation; (5) defendant's riparian rights were not taken because defendant did not own the land when the Act was passed; and (6) enactment of the FWPCA did not retroactively render the Refuse Act unconstitutional, and if their combined effect was unconstitutional, the attack should be upon the FWPCA. Defendant's motion to dismiss was denied. (Hart-Florida) W72-02428

A SYSTEM OF RIGHTS FOR USE IN THE MANAGEMENT OF WATER QUALITY, Washington Univ., Seattle. Dept. of Civil Engineer-

For primary bibliographic entry see Field 05G. W72-02442

APPENDIX: PROPOSED LAKE MICHIGAN AND ADJOINING LAND RESOURCE MANAGE-MENT AND PRESERVATION ACT. State of Illinois, Lake Michigan and Adjoining Land Study Commission.

For primary bibliographic entry see Field 05G. W72-02460

NEW DIRECTIONS IN STATE ENVIRONMEN.

TAL PLANNING, Smithsonian Institution, Washington, D.C. Woodrow Wilson International Center for For primary bibliographic entry see Field 05G.

ENVIRONMENTAL QUALITY AS A POLICY AND PLANNING OBJECTIVE. Carolina Univ., Chapel Hill.

M. M. Hufschmidt.

W72-02466

Journal of the American Institute of Planners, Vol 37, No 1, July 1971, p 231-242. 1 fig, 70 ref.

Descriptors: \*Environment, \*Quality control, \*Planning, \*Decision making, \*Multiple purpose, Regulation, Federal government, Analysis, Evalua-

Identifiers: Strategy, Implementation, National goals, Indirect and direct means.

A national environmental quality goal should be developed and considered along with national goals for economic growth, employment, economic stability, equitable distribution of income and opportunity, and public health and safety, to maintain a multiple objective planning approach. Analysis would proceed from an evaluation of these goals to a definition of instrumental goals, or objectives and finally to the development of policies and programs for the achievement of these objectives. Multiple objective planning evaluates environmental quality issues in terms of their contribution to all major public objectives. A preferred environmental quality strategy combines direct and indirect means of influence. Indirect means, such as environmental monitoring, public information, research, and support of decentralized decision making, offer large longterm payoffs. Direct regulation and legal sanctions are also necessary, particularly for short-run improvements. Nationally, the governmental environmental policy has been enunciated, the or-ganizational framework has been established, and ganizational framework nas oen established, and specific legislation and appropriations have been enacted or proposed. It has not been determined whether emphasis will be placed on the 'problem-solution' approach or on the 'problem-objectives-alternatives-best solution' approach. There is some hope that progress in the development of policies, programs, and administrative structures in the area of environmental quality will occur simultaneously with progress in programs involving other impor-tant national goals. (Strachan-Chicago) W72-02467

WATER MANAGEMENT AND THE PUBLIC, Colorado State Univ., Fort Collins. Dept. of Political Science. For primary bibliographic entry see Field 06B. W72-02477

SOME NOTES ON APPROACHES AND VIEW-POINTS OF PRIVATE AGENCIES TO METROPOLITAN WATER MANAGEMENT, Reitz and Jens, Inc., St. Louis, Mo. For primary bibliographic entry see Field 06B. W72-02480

SOME CHALLENGES POSED BY TRADI-TIONAL INSTITUTIONS AND PRACTICES, Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 06B.
W72-02481

### Field 06-WATER RESOURCES PLANNING

#### Group 6E-Water Law and Institutions

APPROACHES AND VIEWPOINTS OF STATE NATURAL WATER RESOURCES AGENCIES, Rutgers-The State Univ., New Brunswick, N.J. Water Resources Research Inst. For primary bibliographic entry see Field 06B. W72-02485

REGIONAL WATER RESOURCES PLANNING: A STATE VIEW, Minnesota Water Resources Planning and Basin

Minnesota Water Resources Planning and Basin Coordination, St. Paul. For primary bibliographic entry see Field 06B. W72-02487

# WATER RESOURCES RESEARCH ACT AMENDMENTS.

Hearing-Subcomm. on Irrigation and Reclamation-Comm. on Interior and Insular Affairs, House of Representatives, 92d Cong, 1st Sess, June 29, 1971. 181 p, 1 fig, 3 tab.

Descriptors: \*Water Resources Research Act, \*Universities, \*Grants, \*Federal government, \*Research facilities, Training, Manpower, Contracts, State governments, Colleges, Organizations, Water resources development, Water reuse, Irrigation, Environmental sanitation, Water management (Applied), Water allocation (Policy), Water conservation, Water pollution, Water quality, Scientific personnel, Data storage and retrieval, Data transmission, Financing.

The Water Resources Research Act of 1964 has four primary objectives: (1) to establish water resources research centers in each of the 50 states and Puerto Rico; (2) to promote a more adequate national program of water and water related research; (3) to train water resources scientists and technicians; and (4) to make generally available information and reports on projects completed, in progress, or contemplated, in addition to publication of information by the institutes themselves. Proposed bills would amend section 100 (a) of the Act so as to increase the present \$100,000 max imum authorized appropriation for support of each state university center to either \$200,000 or \$250,000. Adjustment of this maximum reflects changes in the cost of research and training programs. Authorization is provided for the use of funds for the dissimination of scientific information. produced by the various programs. Those speaking at the hearing, either for or against the proposed amendments, were primarily congressmen and senators, state officials, and representatives from the various state water resources research centers. (Rees-Florida) W72-02488

#### ARTIFICIAL LAKES AND LAND SUBDIVI-SIONS.

J. A. Kusler. Wisconsin Law Review, Vol 1971, No 2, p 369-448, 1971. 80 p, 285 ref.

Descriptors: "Wisconsin, "Lakes, "Land development, "Regulation, "Project planning, State governments, Local governments, Dams, Land use, Land management, Administrative agencies, Streams, Recreation, Riparian rights, Assimilative capacity, Sewers, Surface waters, Zoning, Nonstructural alternatives, Sites, Surveys, Water utilization, Urbanization, Optimum development plans.

Identifiers: \*Artificial lakes.

Regulatory and nonregulatory techniques to minimize short and long-term construction and land subdivision problems associated with real estate projects using artificial lakes are considered in this article. Several recent artificial lake development projects in Wisconsin are described. The procedures involved in such projects are delineated. Policy issues involved with artificial lake projects are considered. For example, the role of artificial lakes in satisfying recreation demands is explored. Regulation of artificial lake development

is also explored in terms of the state police power and constitutional restraints, control of dams, subdivision regulations, and surface water zoning. Nonregulatory techniques for minimizing lake development problems are considered. Deed restrictions inserted by the developer, common law suits by private landowners, and maintenance programs are among the techniques examined. Fifteen recommendations are presented for actions by state and local governments to ameliorate problems in the development of artificial lakes. (Hart-Florida)

#### **PUBLIC LAND POLICY ACT OF 1971.**

Hearings—Subcomm. on the Environment—Comm. on Interior and Insular Affairs, House of Representatives, 92d Cong, 1st Sess, July 26, 27, 28, 29, 30, 1971. 476 p, 18 tab.

Descriptors: \*Public lands, \*Land use, \*Land development, \*Planning, \*Legislation, Administrative agencies, Organizations, Federal government, State governments, Government finance, Grants, Compensation, Administrative costs, Decision making, Land resources, Land tenure, Withdrawn lands, Regulation, Adjudication procedure, Judicial decisions, Jurisdiction.

The Act emphasizes retention rather than disposal, the enhancement of environmental quality, equitable treatment, and coordination of planning. It would provide a planning system; establish supplementary administrative procedures; and provide assistance to regional, state, and local govern-ments. Procedures are established for administrative rule making, including mandatory provisions for public participation through advisory bodies, hearings, and adjudication. National and subsidiary advisory boards are created, in addition to regional, state, district, and local advisory committees ap-pointed by local federal officials. Sections 8 thru 13 provide for regional coordination by establishing a 'Federal Public Land Use Coordinating Committee' for each of 10 public land regions and an 'Interstate Land Use Coordinating Commission' to represent local interests. Mandatory planning procedures are outlined. Specific limitations on executive withdrawals as to both acreage (5,000) and term (10 years) are provided. Congressional responsibility for other withdrawals is reasserted. Judicial review shall be in any U.S. District Court. Agency enforcement must begin within one year after enactment. The reports of various federal agencies and the statements of officials from both public and private organizations are presented. (Rees-Florida) W72-02490

#### FEDERAL RECLAMATION LAW,

Michigan Univ., Ann Arbor. School of Law. J. L. Sax.

Reprint, Waters and Water Rights, A Treatise on the Law of Waters and Allied Problems, Vol II, 1967. 181 p, 1 tab, 684 ref.

Descriptors: \*United States, \*Federal Reclamation Law, \*Project feasibility, \*Cost repayment, Federal government, Water law, Administration, Administrative agencies, Planning, Legal aspects, Legislation, Regulation, Public lands, Land reclamation, Economics, Reclamation states, Costbenefit analysis, Project planning, Feasibility studies, Water rights, Water utilization.

This article commences with a discussion of the need for a national reclamation program, the statutory basis for the program, and a brief description of the present program. The concept of the reclamation fund is considered, along with the proper procedure for obtaining authorization for projects. The latter is primarily concerned with the required feasibility tests. After discussion of such specific problems in project planning as fish and wildlife protection and conservation of scenic and historic values, the article considers the different methods

of acquiring rights in land and water necessary for reclamation projects. There are certain legal rights in both the water users and the federal government arising from any reclamation project; these rights are examined, along with the restrictions on those involved in reclamation projects. A lengthy discussion evaluates the excess-land restriction with respect to its purpose, its implementation, and the attempts made to avoid the requirement. The article ends with a discussion of the different water uses in reclamation projects and the means of cost repayment utilized by the United States. (Johnson-Florida) W72-02491

EQUITY AND ANTI-POLLUTION POLICY, Institute for Defense Analyses, Arlington, Va. Program Analysis Div. For primary bibliographic entry see Field 05G. W72-02492

WISE MANAGEMENT OF NORTH CAROLINA WATER RESOURCES THROUGH LAW--AN ORIENTATION BROCHURE-VOL. II. North Carolina State Dept. of Water Resources, Raleigh.

August, 1966. 179 p, 5 plate, 11 tab, 19 ref.

Descriptors: \*North Carolina, \*Water resources development, \*Non-structural alternatives, \*Water resources, Water law, Planning, Water Resources Research Act, Water rights, Riparian rights, Prior appropriation, Prescriptive rights, Judicial decisions, Legislation, Administrative agencies, State governments, Water utilization, Recreation, Streams, Rivers, River basins, River basin development.

Volume II of this orientation brochure on North Carolina water resources law contains the nine appendices to Volume I. Appendix A sets forth the proposed water resources law submitted to the North Carolina legislature and the ensuing resolution. All of the statutes concerning the responsibility of the Water Resources Board, Commission, and Committee, which utilize the Department of Water Resources administrative staff, are contained in Appendix B. A synopsis of state law, policies, and organizations related to water are in Appendix C. A primer on nationwide water law, so contained in Appendix D. Appendix E delineates water law research in progress or contemplated. The availability and demand of water in North Carolina is discussed in Appendix F, while the status of the North Carolina water plan is shown in Appendix G, which also considers federal-state relations and federal laws. A functional description of the Department of Water Resources and related agencies is contained in Appendix H, and Appendix I lists publications of the Department of Water Resources. (Hart-Florida) W72-02493

PORTS AND WATERWAYS SAFETY ACT OF 1971 (A BILL TO PROMOTE THE SAFETY OF PORTS, HARBORS, WATERFRONT AREAS, AND NAVIGABLE WATERS OF THE UNITED STATES).

Senate Bill 698, 92d Cong, 1st Sess, 1971. 5 p.

Descriptors: \*Harbors, \*Safety, \*Transportation, \*Control, Navigable waters, United States, Federal government, Regulation, Administrative agencies, Standards, Investigations, Inspection, Ships, Structures, Docks, Explosives, Fuels, Accidents, Foreign trade, Treaties, International waters, Remedies.

To promote safe maritime transportation and environmental quality of harbors, standards and regulations may be enacted to prevent the destruction or damage of vessels or facilities in or adjacent to navigable waters and to protect these waters and resources therein. The Secretary of the Department in which the Coast Guard is operative is authorized to: (1) prescribe marine traffic control

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#### Nonstructural Alternatives—Group 6F

procedures and to establish and approve control systems for commercial vessels; (2) regulate the chorage, mooring, and movement of vessels inanchorage, mooring, and inventent of vessels in-cluding taking possession to prevent damage to car-go, supplies, or fuel; (3) establish and approve measures for handling and storing explosives and other dangerous articles; (4) prescribe minimum equipment requirements for facilities to protect against fire and other casualties; (5) establish safety zones for vessels; and (6) establish inspection procedures to assure compliance with the Act. The Act does not apply to foreign vessels, nor does it hamper the right of innocent passage. In making authorized investigations, the Secretary may subpoena witnesses, require the production of docu-ments, and request judicial assistance in federal disments, and request posterial assistance in rederal dis-trict court to compel compliance. Violation is punishable by a civil penalty up to \$1,000 or a criminal penalty of up to \$10,000 and 10 years im-prisonment. Vessels in violation are liable in rem. (Rees-Florida) 72-02494

#### WATER RESOURCES PLANNING ACT. Senate Bill 21, 89th Cong, 1st Sess (1965). 25 p.

Descriptors: \*Water Resources Planning Act, \*Water resources development, \*Long-term planning, \*River basin development, Federal government, Legislation, Water resources, Interstate commissions, State governments, Administrative agencies, Natural tration, Administrative agencies, Natural resources, Research and development, Water policy, Water supply, Water utilization, Legal aspects, Planning, Water quality control, Non-structural al-

This bill provides for the optimum development of the nation's natural resources through coordinated planning of water and related land resources, through establishment of a water resources council and river basin commissions, and by providing financial assistance to states in order to increase their participation. The water resources council would be composed of the heads of primary federal administrative agencies. The council is responsible for coordinating water resources planning, and making recommendations to the President and Congress on establishment of river basin commissions. River basin commissions may be established by Presidential declaration. The commission would be composed of members from the federal government and the affected states. River basin commissions engage in water resources planning within their jurisdiction, and submit plans to the council. Additionally, financial assistance is furnished the states for comprehensive planning. The funds would be allocated on the basis of population, land area, water resources problem, and need. Requirements for council approval of state water resources programs are set forth. (Hart-Florida) W72-02495

# ENVIRONMENTAL QUALITY: THE GOVER-

NOR OF MARYLAND SPEAKS OUT, Senate, Washington, D.C. For primary bibliographic entry see Field 05G. W72-02496

# INTRODUCTION OF THE MARINE ENVIRON-MENT AND POLLUTION CONTROL ACT OF

Senate, Washington, D.C.

Congressional Record, Vol 116, No 22, p S1960-66 (daily ed February 19, 1970). 7 p.

Descriptors: \*Water pollution control, \*Water pollution effects, \*Waste disposal, \*Sea water, \*Planning, Environmental sanitation, Administrative agencies, Regulation, Permits, Standards, Investigations, Adjudication predure, Decision making, Data collections, Mining, Fisheries, Recreation, Ships, Remedies, Damages, Coasts, Oil wells, Municipal wastes, Federal government. The Marine Environment and Pollution Control Act is proposed as legislation. United States citizens, including corporate and municipal officers, would be prohibited from disposing refuse into the Great Lakes, territorial seas, Continental Shelves, or high seas without a permit from the Secretary of the Interior in concurrance with the Council on Environmental Quality. Before issuing permits, the Secretary must investigate the effects of such disposal, hold public hearings, and provide public participation at all levels of decision making if no adverse effects on marine plants and animals are found, the permit would be issued. All marine dumping should terminate by June 30, 1975, except when the Secretary determines there exists no viable technical alternative. Criminal penalties (imprisonment) and fines up to \$1000 per ton discharged are provided. A marine environment management system would be established to regu-late offshore submerged lands under the Secreta-ry's jurisdiction. Provision is made for development of physical and ecological systems to predict effects of dumping. Comprehensive resource management plans would be developed whenever the secretary is notified that present or potential uses may endanger marine life or whenever submerged lands are to be leased. (Rees-Florida) W72-02497

# THREE FRONTS OF FEDERAL ENVIRONMEN-TAL POLICY, North Carolina Univ., Chapel Hill.

R. N. L. Andrews. Journal of the American Institute of Planners, Vol 37, No 4, July 1971, p 258-266. 24 ref.

Descriptors: \*Environment, \*Federal government, \*Planning, \*Decision making, Institutional con-straints, Quality control, Evaluation, Coordination, Resources, Conservation, Management, Legisla-

Identifiers: \*Federal environmental policy, Pollution control, Environmental quality, Residuals, Development, Implementation, Public participa-

Federal environmental policies, as expressed in legislation and agency action, are discussed in terms of three principal dimensions, or fronts: (1) control of pollution or 'residuals', (2) evaluation and coordination of the impacts of Federal programs on environmental quality, and (3) planning for and controlling the uses of environmental resources to protect both developmental and conservational values. From an examination of existing Federal policy on these three fronts of environmental planning, the author suggests six fundamental needs for future policy action: (1) establishment of the principle that individuals or firms should pay the full costs of their residuals, (2) flexible tools for residuals management, (3) legislation to ensure adequate technology assessment, (4) development and implementation of operational environmental criteria for planning, (5) conceptualization of planning for the wisest uses of common property resources, and (6) increased accessibility for citizens to all levels of government which affect them. (Strachan-Chicago) W72-02593

# A CRITIQUE OF THE EFFECTIVENESS OF WATER QUALITY STANDARDS IN POLLU-TION ABATEMENT.

State of Illinois, Lake Michigan and Adjoining For primary bibliographic entry see Field 05A. W72-02600

# INTERBASIN TRANSFER-THE INTERNA-TIONAL DIMENSION, Alberta Univ., Edmonton. Dept. of Geography.

For primary bibliographic entry see Field 06B. W72-02648

#### COUNCIL REPORT.

National Industrial Pollution Control Council, Washington, D.C. For primary bibliographic entry see Field 05G. W72-02682

# STATE REGULATIONS PERTAINING TO LIVESTOCK FEEDLOT DESIGN AND MANAGEMENT DECEMBER 1970, A SUMMA-

RY, Agricultural Research Service, Beltsville, Md. Agricultural Engineering Research Div. William F. Schwiesow. ARS 42 - 189, April 1971, p 1-8. 1 tab.

Descriptors: \*Legislation, \*Statutes, \*Farm waste, Cattle, Laws, Confinement pens.

Identifiers: \*Feedlots, States of United States,

There are no specific regulations pertaining to construction and operation of feedlots in the states of Alabama, Alaska, California, Delaware, Georgia, Idaho, Montana, New Hampshire, Rhode Island, South Carolina, Tennessee, Utah, Vermont, Vir-ginia, and West Virginia. Specific regulations for beef cattle feedlots are applicable in Arizona, Arkansas, Colorado, Iowa, Kansas, Nebraska, Oklahoma, and Texas. Definitions for feedlots vary from a minimum number of animals to any area within which livestock are confined and vegetation suitable for consumption by livestock does not grow. License fees, where required, range up to \$150/year. Penalties range from \$10 per day to \$1,000 per day with imprisonment and restitution of damages possible in some cases. Specific regulations for feedlots are being developed in the states of Illinois, Indiana, Minnesota, Missouri, North Carolina, North Dakota, Oregon, South Dakota, Washington and Wisconsin. Other regulations, such as Public Health Regulations and Water Quality Standards, have jurisdiction over animal wastes in the states of Connecticut, Florida, Hawaii, Louisiana, Maine, Mississippi, New York, Pennsylvania, Maryland, Ohio, New Jersey, Massachusetts, Michigan, and Nevada. At the present time, these regulations are considered adequate in these states. (Schmitt-Iowa State) W72-02849

#### 6F. Nonstructural Alternatives

# FLOOD PLAIN INFORMATION, WILLAMETTE RIVER AND MARYS RIVER, CORVALLIS AND PHILOMATH, OREGON.

Corps of Engineers Portland, Oreg. For primary bibliographic entry see Field 04A. W72-02262

FLOOD PLAIN INFORMATION, BUTTERNUT CREEK, DE WITT AND MANLIUS TOWNSHIPS, ONONDAGA COUNTY, N.Y. Corps of Engineers, Buffalo, N. Y. For primary bibliographic entry see Field 04A. W72-02263

ANALYSIS OF ALTERNATIVE PROCEDURES FOR THE EVALUATION OF AGRICULTURAL FLOOD CONTROL BENEFITS, VOLUME II, Economic Research Service, Washington, D. C. For primary bibliographic entry see Field 06B. W72-02269

#### CONTROL AGRICULTURAL. FLOOD BENEFITS AND LAND VALUES. Corps of Engineers, Alexandria, Va. Inst. for Water Resources.

For primary bibliographic entry see Field 06B.

#### Field 06-WATER RESOURCES PLANNING

### **Group 6F—Nonstructural Alternatives**

SPECIAL FLOOD HAZARD REPORT, GREATER ANCHORAGE AREA, CHESTER, CAMPBELL, FISH AND SHIP CREEKS. Corps of Engineers, Anchorage, Alaska. For primary bibliographic entry see Field 04A. W72-02308

FLOOD PLAIN INFORMATION, CUYAHOGA RIVER, AKRON TO SUMMIT-PORTAGE COUNTY LINE, OHIO.

Corps of Engineers, Buffalo, N.Y. For primary bibliographic entry see Field 04A. W72-02309

EFFECTS OF INTERBASIN TRANSFERS UPON WATER MANAGEMENT ALTERNATIVES IN CENTRAL UTAH,

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 06D. W72-02450

ECONOMIC ANALYSIS OF WATER SUPPLY ALTERNATIVES IN A MULTI-COUNTY IN-DUSTRIAL AREA, Clemson Univ., S.C. Dept. of Agricultural

Clemson Univ., S.C. Dept. Economics and Rural Sociology. For primary bibliographic entry see Field 06B. W72-02458

WISE MANAGEMENT OF NORTH CAROLINA WATER RESOURCES THROUGH LAW--AN ORIENTATION BROCHURE--VOL. II. North Carolina State Dept. of Water Resources, Raleigh. For primary bibliographic entry see Field 06E. W72-02493

#### 6G. Ecologic Impact of Water Development

ENVIRONMENTAL IMPACT STATEMENT

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 08A. W72-02328

ECOLOGY AND PLANNING. British Columbia Univ., Vancouver. For primary bibliographic entry see Field 06B. W72-02464

MULTIDISCIPLINARY **ENVIRONMENTAL** ANALYSIS - JAMAICA BAY AND KENNEDY

George Washington Univ., Washington, D.C. For primary bibliographic entry see Field 06B. W72-02468

THE INTERNATIONAL SIGNIFICANCE OF THE WATER AREAS OF SOUTHERN EUROPE AND ESPECIALLY THAT OF THE DANUBE DELTA.

Kai Curry-Lindahl. Ocrotirea Natur. 14 (1): 5-19. Illus. Map. 1970. Identifiers: Danube, Delta, Europe, Fauna, Flora, International, Phalacrocorax-carbo, Phoenicop-

terus-rosens.

Much of Europe was affected by the ice age which left many low lying areas that later became bogs, meadows, and marshes. During the time of settle-ment of these areas many of these water regions were drained and converted to other uses. elimination of these water spots produced ecologi-cal changes which have affected not only the flora and fauna of these ecosystems but the migrating birds which used them as nesting areas. Some of the birds are Phoenicopterus rosens and Phalacrocorax carbo.--Copyright 1971, Biological Abstracts, Inc. W72-02499 EVERYMAN'S GUIDE TO ECOLOGICAL LIV-

Greg M. Cailliet, Paulette Y. Setzer, and Milton S.

Love. Macmillan New York, N.Y. 1971. 119 p. \$.95. Identifiers: Book, Ecological, Everymans, Guide, Herbicides, Living, Materials, Minerals, Over, Packaging, Pollution, Population, Resources, Tox-ins, Wildlife.

This pocket handbook is written for the general reader wanting to adapt their living habits to be less a part of environmental deterioration. The manual provides suggestions to ease the burden of pollution, waste, overpopulation and resource depletion for the individual householder. Many facts are given on consumption habits of the average Amer-ican, incorporated into outlines for action considering packaging materials (aluminum, glass, plastics and paper), wood products, solid waste disposal, petroleum products, air, water, minerals, food, land and endangered wildlife. Pollutants such as neroucides, cleansers and metallic toxins are discussed along with consumer power and political action. The handbook concludes with recom-mended information and action sources from books, periodicals and organizations listed.—Copy-right 1971, Biological Abstracts, Inc. W72-02562 as herbicides, cleansers and metallic toxins are

THE 'NEW' ENVIRONMENTALISM: AN IN-TELLECTUAL FRONTIER,

Rutgers-The State Univ., Rutgers, N. J. G. Hagevik, and L. Mann.

Journal of the American Institute of Planners, Vol 37, No 4, July 1971, p 274-280. 100 ref.

Descriptors: \*Environment, \*Planning, Technology, Ecology, Ecosystems, Political aspects, Decision making.
Identifiers: \*'New' environmentalism, \*Policy making, \*Literature, Quantification, Urban planning, Socio-economic planning, Public policy.

The article surveys and identifies some of the literature of the 'new' environmentalism. When the amount of literature begins to decrease, perhaps there will be more time devoted to the business of achieving more successful environmental planning. Meanwhile, the volume of 'new' environmentalism literature is significant of the concern and interest that is being invested in this issue. The 'new' en-vironmentalism is much more rigorous and analytic, much less deterministic, than the old. The authors note some basic weaknesses within developments in this field. In the area of technology, little work has been done. The solid waste field has been largely neglected, while a significant to the solid waste field has been largely neglected, while a significant to the solid waste field has been largely neglected, while a significant to the solid waste field has been largely neglected. has been largely neglected, while noise pollution remains a relatively unexplored issue. Much of the voluminous literature which falls under the ecologic label is weak from a public policy viewpoint. The work fails to anticipate satisfactorily the changes in ecosystems which will result from human intervention. A more important issue, in terms of its long-run significance, is quantification modeling of ecosystems, but this issue has received little recog-nition. The 'new' environmentalism sets itself up as the long-range alternative to dealing with short-range social problems. The political viability of the new environmentalism will depend partly on a recognition that both must be dealt with. Inside the urban planning movement, the 'new' environm talism will gain in importance as it is realized that environmental planning is a kind of socio-economic planning, and not a polar opposite to it. (Strachan-Chicago) W72-02592

THREE FRONTS OF FEDERAL ENVIRONMEN-TAL POLICY, North Carolina Univ., Chapel Hill.

For primary bibliographic entry see Field 06E. W72-02593

RECENT CHANGES IN STRIPED BASS (MORONE SAXATILIS) SPAWNING SITES AND COMMERCIAL FISHING AREAS IN UPPER CHESAPEAKE BAY: POSSIBLE INFLUENCING

FACTORS, Maryland Univ., Solomons. Natural Resources Inst. For primary bibliographic entry see Field 02L. W72-02716

EFFECTS OF RESERVOIR CONSTRUCTION ON NATURE AND THE ECONOMY (VOPROSY FORMIROVANIYA VODOKHRANILISHCH I IKH VLIYANIYA NA PRIRODU I KHOZYAYSTVO).

Perm State Univ. (USSR). Lab. of Water Management Research

ment Research.

Perm, USSR, 1970, 104 p.

Descriptors: \*Reservoir construction, \*Reservoir Descriptors: \*Reservoir construction, \*Reservoir operation, \*Reservoir storage, \*Reservoir stages, \*Aquatic plants, Aquatic weeds, Aquatic life, Vegetation, Grasslands, Grasses, Lake morpholmetry, Dimensions, Shores, Shore-line cover, Shallow water, Groundwater, Water table, Water level fluctuations, Navigation. Identifiers: \*USSR, Perm Oblast, Udmurt ASSR, Kama River, Kama Reservoir, Votkinsk Reservoir, Reservoir regulation, Coves, Geobotany, Phytocoenoses. **Phytocoenoses** 

This collection of 5 papers is the first in a series of monographs devoted to long-term geographic and hydrologic studies of reservoirs in the USSR in connection with their influence on the nature and economy of surrounding lands. This volume, the first to attempt a comprehensive picture of the long-term processes and phenomena occurring in the Kama Reservoir of the Perm Oblast and in the Votkinsk Reservoir of the Udmurt ASSR, both on the Kama River, was prepared under the direction of the Laboratory of Water Management Research of Perm State University in accordance with the program of the International Hydrologic Decade (IHD) to coordinate international research and training programs in hydrology. The topics discussed are: (1) the water level regime and its role in the operation of the Kama Reservoir; (2) problems of reservoir morphometry and zonation;
(3) formation of shallow-water areas in Kama (3) Initiation of Station-water areas in Kama River Reservoirs; (4) development of higher aquatic vegetation in the Kama Reservoir; and (5) effect of the Kama Reservoir on grassy vegetation in the high water-table zone. (Josefson-USGS) W72-02775

### 07. RESOURCES DATA

#### 7A. Network Design

STANDARDS FOR INTERCHANGE OF SURFACE HYDROLOGIC DATA ON COMPUTER MEDIA.

Australian Water Resources Council, Canberra. For primary bibliographic entry see Field 07C. W72-02255

IN-CHANNEL HYDRAULIC GEOMETRY OF STREAMS IN KANSAS, Geological Survey, Lawrence, Kans. For primary bibliographic entry see Field 08B. W72-02322

PRESENT AND FUTURE U HYDROMETEOROLOGICAL DA WATERSHED PROJECT PLANNING, DATA Soil Conservation Service, Casper, Wyo. For primary bibliographic entry see Field 04A. W72-02747

A CLASSIFICATION OF CHANNEL LINKS IN STREAM NETWORKS, Cold Regions Research and Engineering Lab., Hanover, N. H.

For primary bibliographic entry see Field 04A. W72-02862

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### Evaluation, Processing and Publication—Group 7C

# 7B. Data Acquisition

THE NIAGARA RIVER PLUME, PART 2 - THE MIXING OF THE NIAGARA RIVER PLUME IN LAKE ONTARIO.

Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02H.
W72-02276

RADAR SOUNDINGS ON THE PENNY ICE

CAP, BAFFIN ISLAND,
Department of Energy, Mines and Resources, Ottawa (Ontario). For primary bibliographic entry see Field 02C. W72-02283

FIELD MEASUREMENTS OF DIELECTRIC AB-

SORPTION IN ANTARCTIC ICE AND SNOW AT VERY HIGH FREQUENCIES, Scott Polar Research Inst., Cambridge (England); and British Antarctic Survey, London (England). For primary bibliographic entry see Field 02C. W72-02287

AN AUTOMATIC GAUGE FOR MEASURING SEA-ICE THICKNESS, Melbourne Univ., Victoria (Australia). Dept. of

Meteorology. For primary bibliographic entry see Field 02C. W72-02289

AN AERIAL PHOTOGRAPHIC TECHNIQUE FOR BEACH EROSION SURVEYS IN NORTH

Army Coastal Engineering Research Center, Washington, D.C.

For primary bibliographic entry see Field 02L. W72-02687

A COMPARISON OF MACROINVER-TEBRATES COLLECTED BY BASKET AND MODIFIED MULTIPLE-PLATE SAMPLERS, Upper Ohio Basin Office, Wheeling, W. Va.
For primary bibliographic entry see Field 05A.
W72-02689

AN IMPROVED WELDING JIG FOR PELTIER THERMOCOUPLE PSYCHROMETERS,

Pacific Northwest Forest and Range Experiment Station, Wenatchee, Wash. W. Lopushinsky.

Soil Sci Soc Amer Proc. 35 (1): 149-150. Illus. 1971.

Identifiers: Jig, Peltier, Plant, Potential, \*Psychrometers, Soil, Stress, Thermocouple, Water, Welding.

An improved welding jig is described for making fine wire thermocouples for use in Peltier thermocouple psychrometers. Procedures are described for producing thermocouples with little or no twisted wire at the junction. Thermocouples made with the jig were found to produce higher outputs at low water potential than commercially available thermocouples.—Copyright 1971, Biological Abstracts. Inc. ical Abstracts, Inc. W72-02702

PHOSPHORUS-33 AUTORADIOGRAPHY USED TO MEASURE PHOSPHATE UPTAKE BY INDIVIDUAL ALGAE,

New York State Dept. of Health, Albany. Div. of

Labs. and Research.
For primary bibliographic entry see Field 05A.
W72-02718

OF MECHANISMS CONTROLLING THE ULTRAVIOLET PHOTOCHEMISTRY OF ASSOCIATED AND POLYMERIC SYSTEMS, Stanford Research Inst., Menlo Park, Calif. M. Anbar, and G. A. St. John.

Available from NTIS, Springfield, Va. 22151 Price \$3.00 paper copy. National Aeronautics and Space Administration Contractor Report NASA GR-1935, October 1971. 55 p, 8 fig, 4 tab, 102 ref. NASA Contract NAS 2-5937.

Descriptors: \*Ionization, \*Water, \*Alcohols, \*Ultraviolet radiation, \*Analytical techniques, Chemical reactions, Fluorides, Light intensity, Hydrogen Identific ers: \*Photoionization, Photochemistry,

Photons, Wavelengths.

Liquid water and alcohols undergo photoionization when subjected to vacuum ultraviolet in the range of 180 to 260 nm. Hydrated electrons are identified as products of photolysis in liquid water by a number of characteristic reactions using competition kinetics as a quantitative criterion. The photoproduction of electrons was the result of a single photon process with a cutoff wavelength of 205 nm. Photoionization of liquid water thus occurs at energies below the ionization potential in the gas phase. A parallel investigation of the photodissociation of water to H .. OH suggests that photoionization and photodissociation of liquid water involve the same excited state; the cross secwater involve the same excited state; the cross section for photodissociation of water is about seven times larger than that for photoionization. The photoionization of liquid water at relatively long wavelengths has geochemical and cosmochemical implications, as well as important inputs to photochemistry and radiation chemistry. (Woodard-USGS) W72-02744

SOME APPLICATIONS OF GEOPHYSICAL WELL LOGGING TO BASALT HYDROGEOLO-

GY, Washington State Univ., Pullman. Div. of En-

wasnington State Univ., Puliman. Div. of Engineering Research.

J. W. Crosby III, and J. V. Anderson.

Groundwater, Vol 9, No 5, p 12-20, SeptemberOctober 1971. 3 fig, 1 tab, 8 ref. (Partially supported by OWRR funds).

Descriptors: \*Borehole geophysics, \*Basalts, Stratigraphy, Aquifer characteristics, Subsurface investigations, Logging (Recording), Electrical well logging, Hydrogeology, Electrical studies, Acoustics, Radioactivity techniques, Water tem-perature, Tracers, Flowmeters.

Composite logging techniques can be used to define the hydraulic regime of a well in basalt. Some of the logging measures, may become power-ful tools for identifying anomalous conditions associated with pollutant dispersion in an aquifer. Positive correlations of basalt using logging methods have not yet been made over distances greater than 20 miles. Use of a greater number of logging sites permits intermediate points of correlation to be established and further extensions of correlation are possible. Both major and minor log fearetation are possible. Both major and minor log lea-tures of the basalts display varying degrees of lateral persistence. Because driller's logs are generally inadequate in describing subtleties of basalt geology, subsurface correlations are best basait geology, subsurface correlations are best made with geophysical logs. In areas with extensive surficial cover, the geophysical methods may prove to be a very practical method of determining basalt stratigraphy. (Knapp-USGS) W72-02756

PHYTOPLANKTON SAMPLING WITH THE

SEDGWICK-RAFTER CELL, Darling (Ira C.) Center for Research Teaching and Service, Walpole, Me. Bernard McAlice.

Limnol Oceanog. 16 (1): 19-28. Illus. 1971. Identifiers: Abundance, Cell, \*Phytoplankton, Rafter, Sampling, Sedgwick, Statistic, Test.

Quantitative processing of large numbers of phytoplankton collections requires a sampling method that will yield precise and reproducible estimates of abundance within an acceptably short counting time. A 2-stage sampling plan was developed, using the Sedgwick-Rafter cell, which satisfies these criteria. The sampling design is appropriate for larger phytoplankton species (\$10-15 micron) having relatively than population densities (greater than or equal to 100000 cells/liter).—Copyright 1971, Biological Abstracts, Inc. W72-02792

RADIOACTIVE SEDIMENT TRACER TESTS, HOUSTON SHIP CHANNEL, HOUSTON, TEX-

Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 02J. W72-02830

SOME EVIDENCE OF METEOROLOGICAL RELATED CHARACTERISTICS OF LAKE SURFACE TEMPERATURE STRUCTURE, Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland

For primary bibliographic entry see Field 02H. W72-02879

DYE INJECTION IN THE VICINITY OF THE THERMOCLINE,

Waterloo Univ. (Ontario). Dept. of Mechanical Engineering. For primary bibliographic entry see Field 02H. W72-02885

LIMNOLOGICAL TOWER FOR 40 M

Waterloo Univ. (Ontario). Dept. of Mechanical Engineering. For primary bibliographic entry see Field 02H. W72-02886

THE AGROTENSIOMETER, AN INSTRUMENT FOR MEASURING MOISTURE OF IRRIGATED

Institutul Agronomic, Bucharest (Rumania). For primary bibliographic entry see Field 03F. W72-02935

#### 7C. Evaluation, Processing and Publication

STANDARDS FOR INTERCHANGE OF SUR-FACE HYDROLOGIC DATA ON COMPUTER MEDIA.

Australian Water Resources Council, Canberra.

Available from Australian Dept. National Develop-ment P O Box 850, Canberra City, A.C.T. Australia 2601. Australia Water Resources Council Publica-tion, Australian Government Publishing Service, Canberra, 1971. 25 p, 5 fig, 4 append.

Descriptors: \*Hydrologic data, \*Computer programs, \*Data storage and retrieval. \*Standards, Specifications, Data processing, International commissions, Data transmission, Computer models, Surface waters, Meteorological data. Identifiers: \*Australian Water Resources Council, Computer-compatible media, Magnetic tape.

A specification of standards is presented for a generalized scheme for interchange of surface hydrologic data on computer compatible media. In-cluded are formats, media and codes to be used, and an initial s specification of material to be transferred, together with recommended units. The specification is devised only for transfer of data and specification is devised only for transfer of data and in a form compatible between different computer systems. Magnetic tape is the prefferred medium for transfer of data. Details are given of the media and codes involved, and the format scheme is described and examples given. Four attached ap-pendices contain coded character set and its implementation, examples of data form, catalogue list of

#### Field 07—RESOURCES DATA

### Group 7C—Evaluation, Processing and Publication

media, system label formats, and a sample request form for transfer of data. The Australian Water Resources Council working groups made the recommendations on which the conclusions presented in this report are based. (Lang-USGS) W72-02255

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 13. SNAKE RIVER RACIN

Geological Survey, Washington, D.C.

Available from Sup Doc, GPO, Washington, D C 20402, \$3.75. Geological Survey Water-Supply Paper 1934, 1971. 776 p, 1 fig, 1 plate.

Descriptors: \*Surface waters, \*Streamflow, \*Flow measurement, \*Hydrologic data, \*Data collections, Idaho, Nevada, Oregon, Utah, Washington, tions, toano, Nevaoa, Oregon, Utan, wasnington, Wyoming, Gaging stations, Flow rates, Stream gages, Discharge measurement, Average flow, Low flow, Peak discharge, Lakes, Reservoirs. Identifiers: \*Snake River basin (Northwest U.S.).

This volume of Surface Water data for the Snake River basin in Idaho, Nevada, Oregon, Utah, Washington and Wyoming is one of a series of 37 reports presenting records of stage, discharge, a content of streams, lakes, and reservoirs in the United States during the 1961-65 water years. The tables of data include a description of the gaging station, and daily, monthly, and yearly discharges of the stream. The description of the station gives the location, drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs, a description of the station and a monthly summary table of stage and contents are given. Data for partial-record stations include discharge measurements of low-flow partial-record stations, and annual maximum stage and discharge at crest-stage stations. (Woodard-USGS) W72-02265

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 3. OHIO RIVER BASIN, VOLUME 3.

Geological Survey, Washington, D.C.

Available from Sup Doc GPO, Washington D C 20402, \$3.00. Geological Survey Water-Supply Paper 1909, 1971. 554 p, 1 fig, 1 plate.

Descriptors: \*Streamflow, \*Hydrologic data, \*Ohio River, \*Gaging stations, \*Data collections, Flow measurement, Kentucky, \*Illinois, Indiana, Surface waters, Flow rates, Average flow, Low flow, Peak discharge, Reservoirs, Water levels, Stream gages, Discharge measurement. Identifiers: \*Ohio River basin.

This volume of surface water data for the Ohio River basin from Louisville, Ky., to the Wabash River is one of a series of 37 reports presenting records of stage, discharge, and content of streams, lakes, and reservoirs in the United States during the 1961-65 water years. The tables of data include a description of the gaging station, and daily, monthly, and yearly discharges of the stream. The description of the station gives the location, drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs, a description of the station and a monthly summary table of stage and contents are given. Data for partial-record stations include discharge measurements at low-flow partial-record stations, annual maximum stage and discharge at crest-stage stations. (Woodard-USGS) W72-02266

NONTHERMAL SPRINGS OF UTAH. Geological Survey, Salt Lake City, Utah For primary bibliographic entry see Field 02F. W72-02275 A GEOMORPHIC MAP OF LAKE MICHIGAN SHORELINE, United States Lake Survey, Detroit, Mich.

For primary bibliographic entry see Field 02H. W72-02341

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 2. SOUTH ATLANTIC SLOPE AND EASTERN GULF OF MEXICO BASINS, VOLUME 3. Geological Survey, Washington, D.C.

Available from Sup Doc GPO, Wash, D C 20402 -\$4.00. Geological Survey Water-Supply Paper 1906, 1970. 774 p, 1 fig, 1 plate.

Descriptors: \*Streamflow, \*Flow measurement, \*Hydrologic data, \*Data collections, \*Stream gages, Alabama, Georgia, Florida, Mississippi, Surface waters, Gaging stations, Flow rates, Lakes, Reservoirs, Water levels, Average flow, Low flow, Peak discharge. Identifiers: \*South Atlantic Slope, \*Eastern Gulf of

Mexico Basins, Streamflow basic data, Crest stage.

This volume of surface water data for the South Atlantic Slope and Eastern Gulf of Mexico Basins from Apalachicola River to Pearl River is one of a series of 37 reports presenting records of stage, discharge, and content of streams, lakes, and reservoirs in the United States during the 1961-65 water years. The tables of data include a description of the gaging station, and daily, monthly, and yearly discharges of the stream. The description of the station gives the location, drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs a description of the station and a monthly summary table of stage and contents are given. Data for partial-record stations include measurements at low-flow partial-record stations and annual maximum stage and discharge at crest-stage stations. (Woodard-USGS)

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 14. PACIFIC SLOPE BASINS IN OREGON AND LOWER COLUMBIA RIVER BASIN.

Geological Survey, Washington, D.C.

Available from Sup Doc, GPO, Washington, D C 20402 - \$4.50. Geological Survey Water-Supply Paper 1935, 1971. 957 p, 1 fig, 1 plate.

Descriptors: \*Streamflow, \*Stream gages, measurement, \*Hydrologic data, \*Oregon, Washington, Columbia River basin, Pacific Washington, Columbia River basin, Pacific Northwest U.S., Data collections, Surface waters, Gaging stations, Flow rates, Lakes, Reservoirs, Average flow, Low flow, Peak discharge. Identifiers: \*Pacific Slope basins (Ore)

This volume of surface water data for the Pacific Slope basins in Oregon and Lower Columbia River basin is one of a series of 37 reports presenting records of stage, discharge, and content of streams, lakes, and reservoirs in the United States during the 1961-65 water years. The tables of data include description of the gaging station, and daily, monthly, and yearly discharges of the stream. The description of the station gives the location, drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs a description of the station and a monthly summary table of stage and contents are given. Data for partial-record stations include mea surements at low-flow partial-record stations and annual maximum stage and discharge at crest-stage stations. (Woodard-USGS) W72-02349

AN ANALYSIS OF HYDROLOGIC TIME SERIES AND GENERATION MODELS OF

SYNTHETIC FLOWS FOR SOME INDIANA WATERSHEDS, Purdue Univ., Lafayette, Ind. Water Resources Center.

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For primary bibliographic entry see Field 02A. W72-02351

EXPERIMENTAL INVESTIGATION HYDRAULIC TRANSIENTS IN RIVER-RESERVOIR SYSTEMS - PHASE II.

Tennessee Univ., Knoxville. Dept. of Civil Engineering and Engineering Mechanics. For primary bibliographic entry see Field 02E. W72-02434

CORRELOGRAM ANALYSIS REVISITED. Thomas J. Watson Research Center, Yorktown Heights, N. Y. For primary bibliographic entry see Field 04A. W72-02863

EVALUATING ALTERNATIVE TECHNIQUES OF FLOODPLAIN MAPPING,

Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering. M. G. Wolman.

Water Resources Research, Vol 7, No 6, p 1383-1392, December 1971. 2 fig, 1 tab, 23 ref.

Descriptors: \*Flood plains, \*Mapping, \*Flood plain insurance, Floods, Profiles, Flow profiles, Backwater, Routing, Flood forecasting, Surveys, Terrain analysis Identifiers: \*Flood plain mapping.

A variety of techniques is available for providing information on the frequency and extent of flooding in river valleys. These techniques include the use of physiography, pedology, vegetation, occasional floods, regional floods of selected frequency, and flood profiles and backwater curves. Preliminary estimates of costs suggest that these range from a low of \$1-4/mile of channel to a high of \$400-1000/mile of channel. All estimates of flood hazards and damages contain significant uncertainties deriving from the variability and uncertainty of the estimates of hydrologic, hydraulic, and social phenomena. An accelerating demand for information coupled with recognition of the inherent element of judgment in any determination of flood or damage zones suggests additional emphasis on the adoption of mapping techniques appropriate to the needs of different locations. (Knapp-USGS) W72-02864

STATISTICAL PROPERTIES OF MUL. TIVARIATE FRACTIONAL NOISE

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 04A. W72-02865

A STATISTICAL METHOD FOR FLOW PRE-DICTION, RIVER MURRAY EXAMPLE, Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Mathematical Statistics. For primary bibliographic entry see Field 04A. W72-02866

A FUNCTIONAL ITERATION TECHNIQUE FOR SOLVING THE RICHARDS EQUATION APPLIED TO TWO-DIMENSIONAL INFILTRA-TION PROBLEMS, New Mexico Inst. of Mining and Technology,

Socorro. Dept. of Geoscience. For primary bibliographic entry see Field 02G. W72-02870

#### 08. ENGINEERING WORKS

#### **8A. Structures**

HYDRAULIC FLOW RESISTANCE FACTORS FOR CORRUGATED METAL CONDUITS, Federal Highway Administration, Washington, D.C. Environmental Design and Control Div. For primary bibliographic entry see Field 08B. W72-02292

PRESTRESSING DUCT CURVATURE FORCES, California State Div. of Highways, Sacramento. C. F. Stewart, and E. D. Klein.

Available from National Technical Information Service, Springfield, Va. 22151 as PB 200 085, \$3.00 paper copy, \$0.95 microfiche. California Division of Highways, Bridge Dept. Final Report R and D No. 7-70, December 1970. 18 p, 12 fig.

Descriptors: \*Prestressed concrete, design, \*Ducts, \*Highways, \*Stress analysis, Strength of materials, Design criteria, Testing, Analytical techniques, Bridges, Concrete construction, Concrete structures, Engineering structures, Precast concrete, Compressive strength, Design data, Structural design.

Identifiers: Prestressing duct curvature, Prestressing duct clearance, Post tensioning.

To test the effect of curvature on crushing of rigid type prestressing ducts in bridge construction, segmented beam was stressed, de-tensioned and disassembled for cross section inspection of possible damage. The beam contained six 3 1/2 inch inside diameter tendon ducts placed in a vertical zigzag fashion with approximately 1 inch vertical clearance between them. Each duct touched other ducts which were diagonally above or below at an angle of about 40 degrees from the vertical. There was no visible evidence of ducts tending to crush one into the other. There was, however, evidence of some duct distress-side flattening-where they rested against steel bulkheads used to separate the segments. In the area of the bulkheads there was no evidence of distress, except for minor cracking, in the concrete surroundings the ducts. Horizontal cracks occurred in the sides of most segments along the center of gravity of the prestressing steel. Vertical cracks occurred in the ends of most sediments.
(Woodard-USGS)

California Univ., Berkeley, Dept. of Civil Engineering. 06Experimental Study of the Excitation of Waves Inside a Bottomless Harbor, For primary bibliographic entry see Field 08B. W72.02301

WATER TRANSPORT PROBLEMS OF CENTRAL ASIA IN CONNECTION WITH HYDRAULIC ENGINEERING CONSTRUCTION ON THE AMU DARYA RIVER AND KARAKUM CANAL (VODNOTRANSPORTNYYE PROBLEMY SREDNEY AZII V SVYAZI S GIDROTEKHNICHESKIM STROITEL'STVOM NA AMUDAR-YE I KARAKUMSKOM KANALE),

V. G. Krasheninnikov.

Izvestiya Vsesoyuznogo Geograficheskogo Obshchestva, Vol 103, No 4, p 326-334, July-August 1971.

Descriptors: \*Water resources development, \*River basin development, \*Construction, \*Transportation, \*Hydraulic engineering, Hydraulic structures, Canals, Hydroelectric plants, Reservoirs, Railroads, Ships, Navigation, Navigable waters, Inland waterways, Irrigation, Irrigated land, Economics, Investment.

Identifiers: \*USSR, \*Central Asia, Turkmen SSR, Amu Darya River, Syr Darya River, Aral Sea, Karakum Canal, Freight transportation, Cargo, Vessels. Of all the rivers of Central Asia, the Amu Darya, flowing from the Pamir Plateau to the Aral Sea, is most suited for transportation of goods and is the only large river in the USSR where individual reaches are open year-round to navigation. Significant changes in the geography of water transport in Central Asia may be expected as a result of the construction of the Karakum Canal, begun in 1954 and presently completed to Geok-Tepe northwest of Ashkhabad (Turkmen SSR). The importance of the canal for irrigation and the possibility of its conversion into a navigable waterway as a result of high cargo requirements are examined against the background of irrigation problems and existing and proposed hydraulic engineering construction in other regions of the Amu Darya and Syr Darya River basins. The increased export of water from the Aral Sea for irrigation is causing a decline in the water level and a consequent decrease in the water borne transportation on the lake. Completion of a railway line to Makat for connections to Orenburg on the Ural River and to Volgograd and Saratov on the Volga will diminish the importance of the lake as an economically practicable transportation corridor. The declining lake level, if unchecked, will reduce the inland sea by the turn of the century to a number of small saline lakes. (Josefson-USGS)

# UNDERWATER PIPELINES (PODVODNYYE TRUBOPROVODY), 10S. I. LEVIN.

Izdatel'stvo 'Nedra', Moscow, 1970. 280 p.

Descriptors: \*Pipelines, \*Pipes, \*Hydraulic engineering, \*Engineering structures, \*Hydraulic structures, Equipment, Operation and maintenance, Specifications, Surveys, Design criteria, Design data, Reliability, Construction, Construction materials, Earthworks, Trenches, Rivers, Reservoirs, Permafrost, Cold regions. Identifiers: \*USSR, Pipeline construction, Pipeline

This monograph consisting of 7 chapters contains up-to-date information on the planning, design, construction, and maintenance of underwater pipelines across rivers and reservoirs. Data are given on the design and on the various materials used in the construction of underwater pipelines in variously complex regions, including permafrost. Three different types of classification of underwater pipelines based on their function or use, design route, and type of material are developed and analyzed. The text is a practical handbook intended to serve scientists and engineers of planning and construction agencies engaged in the building of multipurpose pipelines and may be used by students of technical institutes active in the training of specialists in the field of oil, gas, and water pipeline construction. (Josefson-USGS)

A NOTE ON CHANNEL JUNCTION DESIGN, Army Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 08B. W72-02325

ENVIRONMENTAL IMPACT STATEMENT (DRAFT).
Geological Survey, Washington, D.C.

Availabile from National Technical Information Service, Springfield, Va. 22151 as PB-198 979, \$3.00 paper copy; \$0.95 microfiche. Geological Survey Report, May 10, 1971. 70 p, 28 fig, 2 plate, 5 tab, 23 ref, 10 append.

Descriptors: \*Water pollution control, \*Oil industry, \*Offshore platforms, \*California, \*Legal aspects, Drilling, Permits, Regulation, Oil water, Governments, Oil wastes. Identifiers: Public Rearing (Oil drilling), Oil spills.

This draft environmental impact statement, dated May 10, 1971, presents the environmental factor relating to administrative approval that would permit the installation of two additional drilling and producing platforms, C' and 'Henry', on existing Federal oil and gas leases OCS-P-0241 and OCS-P-0240 in the Santa Barbara Channel offshore California. Three existing platforms, containing approximately 100 wells, are already in operation on the same leaseholds. Current production from these wells is about 76,000 barrels of oil and 38 million cubic feet of gas per day. Public hearings were conducted by the Department of Interior in Santa Barbara, California, on January 13 and 14, 1971, to assist the Department in determining whether special conditions or stipulations should be imposed should approval be given to install these two platforms. Comments received from State and local agencies, as well as over 230 other individuals and private groups, were reviewed in preparing this draft statement. This draft is being released in order to invite comments, suggestions, analyses, and additional data from other Federal bureaus and agencies, from the State of California and its agencies, from local governmental and private entities, and from interested members of the public. (Woodard-USGS)

SYSTEMS ANALYSIS OF WATER DISTRIBU-TION NETWORKS,

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering. For primary bibliographic entry see Field 06A. W72-02357

DEVELOPMENT AND MAINTENANCE OF NAVIGATION CHANNEL, ARKANSAS RIVER, ARKANSAS AND OKLAHOMA. HYDRAULIC MODEL INVESTICATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. J. Franco, and C. D. McKellar, Jr.. Available from the National Technical Information Service as AD-723 946, 53.00 in paper copy. \$0.95 in microfiche. WES Rept no. TR-2-608, Aug 62, 92n

Descriptors: \*Inland waterways, \*Hydraulic models, Dams, Sedimentation, Rivers, Arkansas, Dredging, Channels, \*Channel improvement. Identifiers: Arkansas River.

As part of the studies for development of the multiple-purpose plan to provide a navigable waterway from the Mississipp River to the general area of Tulsa, Oklahoma, a scale model of a typical 10-mile reach of the Arkansas River was used to test various plans for channel improvement and stabilization under conditions of normal sediment load. Principal conclusions were: A dredged cut without an appreciable reduction in the river's sediment load or the addition of regulatory works would only temporarily affect channel conditions; Regulating structures to increase the radius of curvature of bends would tend to provide a more uniform channel cross section and improve channel alignment over crossings; Controlling depths could be increased by contraction of the channel, particularly at crossings. Longitudinal groins would be effective in fixing the location and alignment of the channel over crossings, and would produce some deepening of the channel over the crossings.

NAVIGATION CONDITIONS AT ROBERT S. KERR LOCK AND DAM ARKANSAS RIVER. HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Station, Vicksburg, Miss. For primary bibliographic entry see Field 08B. W72-02822

SOME CHARACTERISTICS OF PRESSURE FLUCTUATIONS ON LOW-OGEE CREST

# Field 08—ENGINEERING WORKS

# Group 8A-Structures

SPILLWAYS RELEVANT TO FLOW-INDUCED STRUCTURAL VIBRATIONS, lowa Inst. of Hydraulic Research, lowa City.

For primary bibliographic entry see Field 08B.

NAVIGATION CONDITIONS AT PIKE ISLAND LOCKS AND DAM, OHIO RIVER: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary W72-02824 ary bibliographic entry see Field 08B.

NAVIGATION CONDITIONS AT LOCK AND DAM NO. 9, ARKANSAS RIVER: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station,

Vicksburg, Miss.

For primary bibliographic entry see Field 08B. W72-02831

AN ANALYSIS OF A DEEP-WATER STRUC-TURE FOR THE GREAT LAKES, United States Lake Survey, Detroit, Mich. For primary bibliographic entry see Field 02H. W72-02878

#### 8B. Hydraulics

NOTES ON TIDAL INLETS ON SANDY

California Univ., Berkeley. Hydraulic Engineering

M. P. O'Brien.

Available from the National Technical Information Service, Springfield, Va., 22151 as AD-726 012, \$3.00 in paper copy, \$0.95 in microfiche. Califor-nia University Hydraulic Engineering Laboratory Report HEL 24-5, May 1971. 52 p, 13 ref.

Descriptors: \*Tidal effects, \*Inlets (Waterways), \*Shores, \*Sands, \*Erosion, Littoral, Currents (Water), Sedimentation, Sediment transport, Coastal structure, Channel morphology, Channel flow, Waves (Water), Reviews. Identifiers: \*Sandy shores.

Over the past 40 years Dean O'Brien at the University of California has written numerous memoranda on the sediment and hydraulic characteristics of tidal inlets on sandy shorelines. These various unpublished memoranda were edited by Dean O'-Brien and reproduced in this report because of their value to the Coastal Engineering Research Center's inlet research program. The notes include data concerning equilibrium flow area, elements of the hydraulic regimen, energy dissipation in a tidal basin, power available for maintenance of flow area, value of tidal prism in maintaining interior channels, stable channels and stable inlets, velocity at the throat of a tidal inlet, friction slope at throat section, duration of tide, tide wave entering a wide deep inlet, set-up in a lagoon by wave action, wave refraction by currents at an inlet, and inlets as traps for littoral currents. (Woodard-USGS)

WITHDRAWAL SELECTIVE CHARAC-TERISTICS OF WEIRS; HYDRAULIC LABORATORY INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. J. L. Grace, Jr.

Army Engineer Waterways Experiment Station Technical Report H-71-4, June 1971. 26 p, 4 fig, 7

Descriptors: \*Withdrawal, \*Lakes, \*Stratified flow, \*Weirs, \*Laboratory tests, Model studies, Analytical techniques, Water quality, Forecasting. Identifiers: \*Selective withdrawal (Lakes). During 1969, the Corps of Engineers conducted laboratory research to determine the characteristics of withdrawal zones resulting from release of flows from randomly stratified lakes over weirs. The study was concerned with developing means of predicting and controlling the quality of water discharged through downstream, fixed-level regulating structures. Stratification was generated in experimental facilities by means of differentials in both temperature and dissolved salt concentration. Density distributions were determined from temperatures and salinities measured with thermistors and conductivity probes. Velocity distributions were obtained by dropping dye particles into the flow and photographing the resulting streaks with movie cameras. Generalized expressions describing the limits of the zone of withdrawal and distribution of velocities were developed from analyses of the velocity and density distribution data. Means for evaluating conditions where the free surface and/or bottom boundary dictates the upper and/or lower bottom boundary dictates the upper and/or lower limits of the withdrawal zones were also determined. With the capability of predicting the velocity distribution for any given density distribution upstream of a weir, the weighted average technique can be applied to predict the value of any water-quality parameter of the outflow for which a profile in the lake is known. (Woodard-IISGS) W72-02271

SCOUR OF SIMULATED GULF COAST SAND BEACHES DUE TO WAVE ACTION IN FRONT OF SEA WALLS AND DUNE BARRIERS, Texas A and M Univ., College Station. Coastal and

Ocean Engineering Div.
For primary bibliographic entry see Field 02J.
W72-02279

HYDRAULIC FLOW RESISTANCE FACTORS FOR CORRUGATED METAL CONDUITS, Federal Highway Administration, Washington, D.C. Environmental Design and Control Div. J. M. Normann, and H. G. Bossy. Available from Sup Doc, GPO, Washington, D.C. 20402, 55 cents. Federal Highway Administration, Office of Research Report, September 1970. 48 p. 18 fig. 13 th. 16 ref. 5 append. 18 fig, 13 tab, 16 ref, 5 append.

Descriptors: \*Hydraulic conduits, \*Flow resistance, \*Hydraulic design, Testing, Flow rates, Mathematical studies, Highways, Construction, Conduits, Hydraulics, Fluid friction, Roughness (Hydraulic). Identifiers: \*Corrugated conduits, Conduit size.

Experimental determinations show that the resistance factors for conduits manufactured of corrugated metal vary over a wide range for each of the different corrugation forms now available. Hydraulic design procedures require a reliable determination of the resistance factor applicable to each specific form. Methods were developed, using all available data, whereby such resistance factors can be determined within close tolerances in terms of either the Darcy f or the Manning n. Variables considered include conduit size and shape, corrugation form, flow rate, and flow depth. Design charts and geometric tables are presented for the commonly available conduits of five corrugation forms. In the 6- by 2-inch structural plate corrugated pipes, the f reaches a peak after which it remains constant as the Reynolds number or wall Reynolds number is increased. If the f for this pipe peaks and then decreases, the error caused by as-suming a constant f is negligible unless very high flow rates are encountered. For such flow rates, a constant f would produce a conservative result, in terms of conduit capacity or required slope. (Woodard-USGS) W72-02292

California Univ., Berkeley, Dept. of Civil Engineer ing. 06Experimental Study of the Excitation of Waves Inside a Bottomless Harbor,

N. Sakuma, J. Buhler, and R. L. Wiegel.

Availabile from National Technical Information
Service, Springfield, Va. 22151 as AD-726 010,

\$3.00 paper copy, \$0.95 microfiche. California University Hydraulic Engineering Laboratory Technical Report HEL-1-17, May 1971. 36 p, 26 fig, 6 ref. Coastal Eng Res Center Contract DACW 72-68-C-0016

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Descriptors: \*Waves water, \*Ocean waves, \*Harbors, \*Recreation facilities, \*Model studies, Fishing, Boating, Mathematical studies, Methodology,

The problem of forced seiches due to surface-water The problem of forced seiches due to surface-water waves is considered in planning enclosed areas in the ocean such as offshore harbors for fishing or recreational boats. Wave heights and wave periods inside and outside the experimental cylinder were measured by means of parallel wire resistance type wave gages and a multichannel rectilinear writing oscillograph. Four wave gages were used to measure the waves; one was used to measure the incident waves and three were used to measure the sure the waves; one was used to measure the incident waves, and three were used to measure the waves inside the cylinder. It was difficult to define a height of the incident wave, especially at higher wave numbers. When the generator was started, the waves gradually increased in height. The effects of reflection became evident before a uniform height was reached. The final tests were made in the large hain in order to minimize the effect of the large basin in order to minimize the effect of the large dash in Order to Infilmize the circumstance these reflections. The modes of oscillation agreed with the ones observed in the small basin for corresponding wave numbers. (Woodard-USGS) W72-02301

IN-CHANNEL HYDRAULIC GEOMETRY OF STREAMS IN KANSAS,

Geological Survey, Lawrence, Kans. C. V. Burns.

Kansas Water Resources Board Technical Report No 8, June 1971. 31 p, 13 fig, 1 tab, 16 ref.

Descriptors: \*Streamflow, \*Channel morphology, \*Rainfall-runoff relationships, \*Hydrologic data, \*Kansas, Data collections, Hydraulic gradient Channel flow, Stream gages, Flow measurement, Flow rates, Mathematical studies, Equations, Reaeration, Hydrographs. Identifiers: \*Hydraulic geometry (Kansas streams).

The rates of increase in a downstream direction in width, depth, and velocity of streams in Kansas are similar to those found for other streams in the Midwest. Information from 117 stream-gaging stations in Kansas and adjoining areas was used to develop the papameters to define the hydraulic geometry of the streams. Hydraulic equations written in terms of discharge were developed by least-squares regression for flows exceeded 10, 50, and 80 percent of the time and for average flow. The equa-tions are used to predict the average width, depth, and velocity of flow for any location on streams in Kansas having drainage areas between 100 and 9,000 squares miles. The average depth and velocity of flow can be used to compute the coefficient of reaeration. (Woodard-USGS) W72-02322

A NOTE ON CHANNEL JUNCTION DESIGN, Army Waterways Experiment Station, Vicksburg,

G. H. Keulegan.

Army Corps of Engineers Waterways Experiment Station Miscellaneous Paper H-69-4, April 1969. 28 p, 2 fig, 4 tab, 7 ref.

Descriptors: \*Channel flow, \*Spillways, \*Design flow, \*Flow control, \*Junction, Model studies, Analytical techniques, Mathematical studies, Channel morphology, Hydrodynamics.

An analytical solution is described for the design of ar analytical solution is described for the usagino a rapid flow channel junction utilizing a spillway type inlet to minimize flow disturbance in the main channel. The dynamic equation of flow for a chan-nel with lateral outflow is used in conjunction with Manning's equation to design an inlet of decreasing width whereby the lateral flow into the main channel is uniformly spread over a predetermined

length of spillway. The computation technique and a sample computation are included. (Woodard-USGS) W72-02325

HEAD LOSSES IN SUBCRITICAL FLOW CHANNEL TRANSITIONS, Army Waterways EXPERIMENT Station, Vicksburg, Miss.

Y. H. Chu

Y. H. Chu. Availabile from National Technical Information Service, Springfield, Va 22151 as \$3.00 paper copy; \$0.95 microfiche. Army Corps of Engineers Waterways Experiment Station Miscellaneous Paper H-68-3, September 1968. 18 p, 12 plate, 2 tab, 9 ref.

Descriptors: \*Head loss, \*Subcritical flow, \*Transition flow, \*Channels, \*Model studies, Channel flow, Turbulence, Flumes, Analtyical techniques, Fluid friction, Energy losses, Hydrodynamics, Channel morphology, Mathemati-cal studies, Systems analysis, Froude number.

A model was used to study head losses for subcritical flows passing channel transitions. Two plywood channels were inserted in a steel flume. The channels were positioned first to operate as a contraction and then as an expansion. By the use of triangular fillet blocks, the wide rectangular channel and the transition reach were transformed, respectively, into a trapezoidal-shaped channel and a broken-type transition. The slope of the fillet block in the uniform channel was 1 on 2. The height of channels was six inches. The expansion loss was appreciably greater than the contraction loss even though the expansion and contraction angles were A model was used to study head losses for subcritithough the expansion and contraction noise even though the expansion and contraction angles were the same. With 12.5 degrees expansions, the flow was not completely expanded along the side wall. The eddy formed on the side of the expansion, and with any minor disturbance in the flow could be moved to the opposite side. The high degree of tur-bulence induced by this eddy contributes to the large energy dissipation for expanding transition. (Woodward-USG\$) W72-02327

EXPERIMENTAL INVESTIGATION OF HYDRAULIC TRANSIENTS IN RIVER-RESE-RVOIR SYSTEMS - PHASE II, Tennessee Univ., Knoxville. Dept. of Civil En-

gineering and Engineering Mechanics.
For primary bibliographic entry see Field 02E.
W72-02434

MODEL STUDY OF GALVESTON HARBOR ENTRANCE, TEXAS. HYDRAULIC MODEL IN-VESTIGATION, Army Engineer Waterways Experiment Station,

Army Engineer waterways Experiment Station, Vicksburg, Miss.
Henry B. Simmons, and Robert A. Boland, Jr.
Available from the National Technical Information Service as AD-723 949, \$3.00 in paper copy, \$0.95 in microfiche. WES Rept no. TR-H-69-2, Feb 69,

Descriptors: \*Breakwaters, \*Hydraulic models, \*Harbors, \*Texas, Navigation, Sedimentation, Ocean currents, Tides, Ocean waves, Test procedures, Jetties, Channels, Dredging, Galveston (Texas).

entifiers: \*Galveston Harbor.

The purposes of the Galveston Harbor model study were to: (a) develop plans for relocation and sta-bilization of the jetty channel on an alignment and at a depth suitable for the safe passage of supertan-kers; (b) determine means for protecting the north-jetty from the undermining action of tidal currents; jetty from the undermining action of tidal currents; (c) determine the shoaling characteristics of the relocated and deepended inner bar portion of the jetty channel, and develop plans for minimizing shoaling the relocated channel; (d) determine the shoaling characteristics of the deepened outer bar portion of the jetty channel; and (e) determine the best locations for additional anchorage area within the letty channel exist Register Roade. the jetty channel or in Bolivar Roads.

W72-02816

HYDRAULIC MODEL STUDIES OF THE TEHAMA-COLUSA CANAL FISH CONCENTRATOR, CENTRAL VALLEY PROJECT, TRATOR, CENTRAL VALLEY PROJECT, CALIFORNIA, Bureau of Reclamation, Denver, Colo. Engineering

and Research Center.
For primary bibliographic entry see Field 081.
W72-02818

NAVIGATION CONDITIONS AT ROBERT S. KERR LOCK AND DAM ARKANSAS RIVER. HYDRAULIC MODEL INVESTIGATION, Engineer Waterways Station,

John J. Franco, and James E. Glover. Available from the National Technical Information Service as AD-723953. \$3.00 in paper copy. \$0.95 in microfiche. WES Rept no. AEWES-TR-H-68-5, Sep 68, 51p.

Descriptors: \*Dams, \*Hydraulic models, \*Rivers, Navigation, River flow, Sedimentation, Test procedures, Oklahoma, Locks. identifiers: \*Robert S. Kerr Dam, Arkansas River.

The Robert S. Kerr Lock and Dam, proposed for construction on the Arkansas River about 395 miles above the junction of the Mississippi and White Rivers, will provide a navigable pool for 37 miles upstream to Webbers Falls Lock and Dam. The project comprises a nonnavigable gated dam with eighteen 50-ft-wide by 44-ft-high tainter gates, a 110 by 600-ft lock on the left bank with a maximum lift of 48 ft, and a four-unit powerhouse with a 110,000-kw generating capacity on the right bank. A 1:120-scale, fixed-bed model, reproducing approximately 3.3 miles of the Arkansas River, was used to determine flood stages at the dam, naviga-tion conditions in the lock approaches, and tendencies for sediment deposition in the lower lock approach, and to develop modifications required to provide satisfactory navigation conditions. The investigation has resulted in the development of modifications in the original design required to produce satisfactory navigation conditions in the approaches to the lock. W72-02822

SOME CHARACTERISTICS OF PRESSURE FLUCTUATIONS ON LOW-OGEE CREST SPILLWAYS RELEVANT TO FLOW-INDUCED STRUCTURAL VIBRATIONS,

Iowa Inst. of Hydraulic Research, Iowa City.

Frederick A. Locher.

Available from the National Technical Information Service as AD-728115. \$3.00 in paper copy, \$0.95 in microfiche. Army Engineers contract Rept no. IIHR-130, Feb 71, 78p. DACW39-68-C-0004.

Descriptors: \*Dams, \*Vibrations, \*Hydrodynamics, \*Spillways, Hydraulic models, Flow, Pressure, Boundary layers, Test procedures. Identifiers: \*Flow visualization, \*Water tunnels,

Curve fitting.

The primary objectives of the experimental program was to determine whether pressure fluctuations induced on the face of a low-ogee spillway under various flow conditions are a possible mechanism for the excitation of spillway vibration. Some of the more important terms and concepts used to describe spillways will be defined at the outset in the interest of clarity. W72-02823

NAVIGATION CONDITIONS AT PIKE ISLAND LOCKS AND DAM, OHIO RIVER: HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station,

Vicksburg, Miss.

J. J. Franco, and H. S. Austin. Available from the National Technical Information Service as AD-723947, \$3.00 in paper copy, \$0.95 in microfiche. WES Rept no. TR-2-577, Aug 61, Descriptors: \*Inland waterways, \*Hydraulic models, Navigation, River flow, Sites, Test methods, Ohio, West Virginia Pike Island Dam, Ohio River, Locks. Identifiers: Site selection, Pike Island dam

The model investigation of the Pike Island Locks and Dam, proposed for construction on the Ohio River, was concerned with the study of navigation conditions in the lock approaches, the procurement of data to aid in selecting one of two proposed sites for the structures, and the development of measures to overcome or minimize the effects of any adverse conditions. The model study also afforded a means by which navigation interests could satisfy themselves, by observing the scale model in operation, as to the acceptability of the propomodel in operation, as to the acceptability of the proposed locks and dam from a navigation standpoint. The locks are to be of the high-lift type, consisting of two parallel locks having clear chamber dimensions of 110 by 1200 ft and 110 by 600 ft. The locks and dam will replace two existing low-lift navigable-type dams and locks. An undistorted 1:120-scale model, reproducing 3.7 miles of the Ohio River and the locks and dam structures, was used for the investigation. The model investigation of the Pike Island Locks used for the investigation. W72-02824

DESIGN FOR OPTIMUM WAVE CONDITIONS, CRESCENT CITY HARBOR, CRESCENT CITY, CALIFORNIA: HYDRAULIC MODES IN-VESTIGATION.

VESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Paul K. Senter, and Charles W. Brasfield. WES Rept no. TR-H-68-6, Sep 68, 68 p.

Descriptors: \*Breakwaters, \*Hydraulic models, \*Harbors, California, Ocean waves, Storms. Identifiers: Harbor models, Crescent City, Califor-

Tests were conducted on a 1:125-scale model of Crescent City Harbor and sufficient adjacent coast-line and offshore bathymetry to permit generation of waves and wavefront patterns from all significant of waves and waverront patterns from an isgnificant directions of wave approach to the harbor. The hydraulic model, equipped with wave-generating and wave-measuring apparatus, was used to deter-mine the optimum length and location of an extension, or extensions, to the existing breakwater system that would reduce to a tolerable level the present adverse effects of storm waves on navigation and mooring conditions in the harbor.

BOUNDARY EFFECTS OF UNIFORM SIZE ROUGHNESS ELEMENTS IN TWO-DIME-NSIONAL FLOW IN OPEN CHANNELS, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Bobby J. Brown, and Yen H. Chu. WES Mise Paper-H-68-5, Dec 68, 72 p.

Descriptors: \*Turbulence, \*Model studies, \*Inland waterways, \*Flow, Velocity, Boundary layer, Statistical methods, \*Channel flow, Velocity, Identifiers: \*Two-dimensional flow, Flow fields, Channel beds, Statistical distribution.

Tests were conducted to investigate the characteristics of the vertical velocity distribution in flow in wide channels with large relative roughness. The study was basically a two-dimensional investigation of the boundary roughness effects in turbulent flow. The investigation was conducted in a 48-ft-long, 2-1/2-ft-wide flume with 1/8-, 1/2-, 3/4-, and 1-in. crushed limestone and 3/4-in. concrete cubes as the boundary roughness. Results indicate that the root-mean-square value of the boundary roughness heights is related to the Nikuradse equivalent sand grain roughness and that the root-mean-square value can be treated as a roughness parameter for boundaries of densely spaced, irregular, randomly placed roughness elements of uniform size. Appendix A includes the experimen-tal data. Appendix B describes the special instru-

#### Field 08—ENGINEERING WORKS

#### Group 8B-Hydraulics

mentation used for measuring the vertical velocity profiles within the flow. W72-02829

NAVIGATION CONDITIONS AT LOCK AND DAM NO. 9, ARKANSAS RIVER: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

John J. Franco, and Louis J. Shows. WES Rept no. TR-2-817, Mar 68, 66 p.

Descriptors: Inland waterways, \*Dams, \*Hydraulic models, River flow, Navigation, Floods, Arkansas, Locks, Spillways, Flood control. Identifiers: Arkansas River.

Lock and Dam No. 9, proposed for construction on the Arkansas River, will provide a navigable pool extending upstream about 25 miles to the lock and dam at Dardanelle (Lock and Dam No. 10). The model investigation was concerned with the study of navigation conditions in the approaches to the lock to determine the adequacy of the proposed design and with the development of measures to overcome or minimize the effects of any adverse conditions. An undistorted 1:120-scale model, reproducing approximately 6 miles of the Arkansas River and adjacent overbank area near Morritton, , including the lock and dam structure, was used for this investigation. The investigation indicated that conditions in the approaches to the lock with the original design would tend to be difficult and hazardous. Satisfactory navigation conditions could be developed in the upper approach with excavation of the right bank above the lock and submerged dikes to reduce the velocity of currents in the approach. Navigation conditions in the lower approach could be improved by providing sufficient maneuver area for downboun move away from the right bank against the currents moving toward the bank. Construction of a wing dike or extension to the lower guard wall would provide the additional protection and maneuver area required. Streamlining the end of the upper guard wall would reduce the disturbance to flow near the end of the wall and improve the distribu-tion of flow through the gated spillway. W72-02831

GENERAL ANALYSIS OF LONGITUDINAL DISPERSION IN NONUNIFORM FLOW, Massachusetts Inst. of Tech., Cambridge. Dept. of

Civil Engineering.
For primary bibliographic entry see Field 05B.
W72-02867

PROBABILITY DISTRIBUTION OF NUMBER OF NETWORKS IN TOPOLOGICALLY RAN-DOM NETWORK PATTERNS,

Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
For primary bibliographic entry see Field 04A.

#### 8C. Hydraulic Machinery

W72-02874

A VIBRO CORER AND PORTABLE TRIPOD--WINCH ASSEMBLY FOR THROUGH ICE SAMPLING.

Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland

For primary bibliographic entry see Field 02J. W72-02345

RECOVERY OF FLOATING OIL: ROTATING DISK TYPE SKIMMER.

Susquehanna Corp., Costa Mesa, Calif. Atlantic Research Systems Div.

For primary bibliographic entry see Field 05G. W72-02367

EXPERIMENTAL EVALUATION OF A PUMP TEST FACILITY WITH CONTROLLED PER-TURBATIONS OF INLET FLOW, National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center. W. Stevans, and R. J. Blade.

Available from NTIS, Springfield, Va. 22151 Price \$3.00 (Paper copy). National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.

Descriptors: \*Pump testing, \*Control systems, \*Pumps, \*Hydraulics, Analytical techniques, Dynamics, Hydraulic equipment, Intakes, Evalua-

Identifiers: \*Pump testing (Controlled perturba-

The relations governing the operation of a pump under periodic fluctuations of inlet pressure and flow were investigated. A specially designed throtthe produced perturbations to the pump inlet flow and pressure over a frequency range of 2 to 60 hertz. The perturbed flow entering the pump was determined by using the acoustical wave equation to determine the flow in the long inlet line and by accounting for the equivalent vibrational flow due to the longitudinal motion of the inlet line. The perturbed flow leaving the pump was determined by using a specially designed multihole orifice plate. Independent checks for establishing the validity of the perturbed data are described and applied to the test data. The measurement methods give reliable values for the perturbed flows. The motion of the test facility must be accounted for when calculating the perturbed flow entering the pump. The dif-ference between the flows entering and leaving the pump was identified as the compliance of the pump structure and the water it contained. The largest volume difference detected was approximately 0.04 cubic inches. (Woodard-USGS) W72-02745

MEASUREMENTS HYDROPOWER PLANT TRANSIENTS, GAR-RISON AND OAHE DAMS, MISSOURI RIVER, NORTH AND SOUTH DAKOTA,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Ellis B. Pickett.

Technical Rept. No. AEWES-TR-68-1, November

Technical Rept. No. AEWES-TR-68-1, November 1968, 124p, 31 fig, 12 tab, 24 ref. Identifiers: \*Power plants, \*Hydraulic systems, Hydrostatics, Dams, Performance (Engineering), Test methods, Test equipment, North Dakota, South Dakota, Mechanical drawings, Tables. Garrison Dam, Oahe Dam, Missouri River, Surge tanks, Penstocks, Hydraulic turbines, \*Hydroelec-

tric power generations.

Prototype tests were conducted in hydro-power plants at Garrison and Oahe Dams to evaluate results of a comprehensive digital computer study by others on the entire problem of power plant transients and to determine the extent to which ac-tual operation corresponded to the design. Mea-surements of power plant transients for different plant loadings, and instantaneous pressure values at a number of locations in the power tunnel, the surge tank system, turbine spiral case, and draft tube were obtained simultaneously with instantaneous values of tunnel flow velocity, reservoir and tailwater elevations, turbine speed and gate opening, power output, and other elements (including governor system). Pressure and water-level measurements were made with electrical pressure transducers, velocities were measured with pres-sure transducers mounted in probes projecting into the flow and connected to pitot-static tubes on cross struts in the penstock, and mechanical and electrical values were obtained with appropriate transducers. Measurements were recorded on about 90 channels of oscillograph and magnetic tape recorders, and digitized for use in the digitized computer analyses. Detailed descriptions are given of the instrumentation, test conditions, and procedures used to obtain the measurements. Examples are given of some of the test data. cross struts in the penstock, and mechanical and

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ENGINEERING PRINCIPLES IN HANDLING LIQUID MATERIALS, Michigan State Univ., East Lansing. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D. W72-02851

AUTOMATIZATION OF URBAN WATER--WORKS IN THE SOVIET UNION, Polish Association of Sanitary Engineering and Technology, Warsaw.
For primary bibliographic entry see Field 05D.
W72-02938

#### 8D. Soil Mechanics

BELTZVILLE LAKE. Army Engineer District, Philadelphia, Pa.

Final foundation report, March 1971. 28 photos.

Descriptors: \*Foundations, \*Dam foundations, \*Foundation investigations, \*Rock foundations, Soil mechanics, Rock mechanics, Lakes, Pennsyl-Identifiers: Beltzville Lake project (Penna)

Gives record of foundation conditions encountered in construction of Beltzville Lake Project (on Pohopoco Creek, Pennsylvania), which consists of a flood control dam with earth embankment (maximum height 170 ft), a concrete control tower, a concrete outlet conduit and stilling basin, and an unlined spillway excavated into rock at north end of dam. Exploration prior to construction included borings, test pits, test embankments and seismic surveys; during construction exploratory core holes (cumulative total of 990 ft) were drilled to check on foundation tightness. Geology of the area and excavation procedures for component parts are discussed. Because of the homogeneous nature of the bedrock special preparation of the foundation was found necessary only in two areas. Foundation anchors were required in the spillway area. The only grouting done prior to concrete placement was in the outlet trench where curtain grouting was performed along the centerline of the dam.
W72-02435

#### 8E. Rock Mechanics and Geology

BELTZVILLE LAKE. Army Engineer District, Philadelphia, Pa. For primary bibliographic entry see Field 08D. W72-02435

#### 8F. Concrete

**EVALUATION OF CONCRETE AND RELATED** MATERIALS FOR DESALINATION PLANTS SECOND ANNUAL PROGRESS REPORT. Bureau of Reclamation, Denver, Colo. For primary bibliographic entry see Field 03A. W72-02950

#### 8G. Materials

PRESTRESSING DUCT CURVATURE FORCES. California State Div. of Highways, Sacramento. For primary bibliographic entry see Field 08A. W72-02293

EARTHQUAKE DAMAGE TO THE LOS AN-GELES SEWER SYSTEM, Los Angeles Dept. of Public Works, Calif. For primary bibliographic entry see Field 05G. W72-02407

#### 81. Fisheries Engineering

THE WINTER MIGRATIONS OF CHAR, SAL-VELINUS ALPINUS L., IN THE HYDROELEC-TRIC RESERVOIRS TUNHORDFJORD AND PALSBUFJORD, NORWAY,

Ministry of Agriculture, Vollebekk (Norway).

Rep Inst Fresh-Water Res Droiining Holm. 50. 5-

44. Illus. 1970. Identifiers: Char, Electric, Hydro, Management, Migrations, Norway, Palsbufjord, Reservoirs, Salvelinus-Alpinus, Tunhovdfjord, Winter.

Char, first introduced into the river system in 1910, now constitute about 85% of the annual catch in the 2 impoundments. Celluloid discs, Lea's hydrostatic tags or Carlin tags were placed on 21,073 char from 1951-68, mostly in winter or in the au-tumn spawning season. Most tagged fish were males because females were often injured in the nets. Postspawning movements were shorebound feeding migrations. As water levels declined and water discharge rates increased, char accumulated in currents near intakes of drainage tunnels. When the current reached a threshold velocity, char interrupted their downstream migration and kept in the current the rest of the winter. Food supply in the current the rest of the winter. Food supply in the current is negligible. Fishing pressure is rela-tively heavy on these concentrated populations. In Tunhovdfjord, the annual rate of exploitation was from 12-25% for distant and local spawning popu-lations respectively. Younger char do not show as lations respectively. Younger char do not show as pronounced migrations as the spawning fish. Ex-perimental fishing by 2 anglers indicated lower fish-ing success in weekends when discharge rates were reduced. Controlled discharge would be a method of managing the harvest. Rapid lowering of water may interfere with spawning success. Char migrated through 15.3 km of tunnel in 1 situation.— Copyright 1971, Biological Abstracts, Inc. W72-02666

HYDRAULIC MODEL STUDIES OF THE TEHAMA-COLUSA CANAL FISH CONCENTRATOR, CENTRAL VALLEY PROJECT, CALIFORNIA, Bureau of Reclamation, Denver, Colo. Engineering

Bureau of Reciamation, Denver, Colo. Engineering and Research Center.

G. L. Beichley.

Available from the National Technical Information Service as PB-199216. \$3.00 in paper copy. \$0.95 in microfiche. REC-ERC-71-4, Jan 71, 22 p.

Descriptors: \*Fishes, Fish barriers, \*Model studies, \*Fish management, Hydraulic models, Salmon, Orifices, Inland waterways, California, Tehama Ca-lusa Canal.

Identifiers: \*Fish concentrators, \*Tehama Calusa

Tests of a 1:2.5 scale model made to develop the design of a fish concentrator to be located on the Tehama-Colusa Canal in California are described. The purpose of the structure is to concentrate chin-ook salmon fingerlings into a flow of 5 cfs from a ook salmon fingerlings into a flow of 5 cfs from a flow of 140 cfs for passage through an electronic counting device. The preliminary design consisted of a 14-ft-long, 10-ft-wide upward sloping perforated plate screen with adjustable orifice plates underneath to control flow through the screen. The screen consisted of four 3.5-ft-long sections. The testing resulted in the following: (1) the first 3 sections were each lengthened by 3 in., and the underlying orifices were repositioned to increase capacity at the full open position; (2) the fourth or downstream section was lengthened to 5 ft and was titled to slope downward: (3) orifice plates under tilted to slope downward; (3) orifice plates under Section 4 were eliminated in favor of a cover plate to regulate flow through that section; (4) the size of the orifices under Sections 1, 2, and 3 was increased by approximately 12.5%; (5) the crest

elevation between Sections 3 and 4 was made adjustable for better flow depth and velocity control; and (6) air vents were provided through the side walls of the space below the orifice plates in Sections 1, 2, and 3.

#### 10. SCIENTIFIC AND TECHNICAL INFORMATION

STANDARDS FOR INTERCHANGE OF SUR-FACE HYDROLOGIC DATA ON COMPUTER

Australian Water Resources Council, Canberra. For primary bibliographic entry see Field 07C. W72-02255

A COMPILATION OF THE LAKES IN OREGON, WITH BIBLIOGRAPHY, Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife. For primary bibliographic entry see Field 02H. W72-02256

PROGRAMMING APPLICATIONS TO THE ECONOMIC PROBLEMS OF WATER QUALITY CONTROL, Purdue Univ., Lafayette, Ind.

For primary bibliographic entry see Field 06A. W72-02358

AN INFORMATION SYSTEM FOR IMPROVING THE EVALUATION OF NONMARKETED OUT-

Army Engineer Inst. for Water Resources, Alexandria, Va.

For primary bibliographic entry see Field 06B. W72-02645

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# CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the Soap and Detergent Association and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Public water supply treatment technology at the American Water Works Association.

## Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association.

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